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POPULAR OBSERVATIONS

ON

APPARENT DEATH

FROM

DROWNING, SUFFOCATION, &c.

WITH

AN ACCOUNT OF THE MEANS TO BE EMPLOYED

FOR RECOVERY.

Drawn up at the Deſire of the NORTHAMPTONSHIRE

PRESERVATIVE SOCIETY:

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INTRODUCTION.

THE time is within the recollection of many now living, when it was almoſt univerſally believed, that *life* quitted the body in a very few minutes after the perſon had ceaſed to breathe. Remarkable examples to the contrary, were indeed upon record; but theſe, beſides being extremely rare, were generally caſes wherein the ſuſpenſion, as well as the recovery of life, had occurred ſpontaneouſly*; they were therefore beheld with aſtoniſhment, as particular inſtances of divine interpoſition, and afforded no ground to hope, that *human* means could prove at all uſeful under ſimilar circumſtances.—Such a view of the matter neceſſarily checked any rational and premeditated attempt at recovery, even in thoſe caſes where the appearance of death was evidently occaſioned by the operation of external and aſſignable cauſes; and it is probably owing to the rude trials which fond attachment may have ſometimes intuitively prompted, that we are indebted for the happy diſcovery of an eſſential difference between *abſolute* and *apparent death*. The ſucceſs which occaſionally attended the the artleſs attempts of uninformed perſons, ſoon attracted the attention of medical men, by whom the means for recovery have been improved, and employed with ſuch happy conſequences, as to have rendered the matter an object of public concern, and highly deſerving of that extenſive encouragement and ſupport which it now enjoys in this, and in ſeveral other countries of Europe.

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* Viz. Thoſe caſes of ſeeming death commonly known by the name of *trances*.

To promote the laudable ſcheme of recovery from a ſtate of Apparent death, the Northamptonſhire Preſervative Society was inſtituted, October 9th, 1789; and altho' of ſo late a date, it's minutes afford ample teſtimony of it's beneficial effects. From thoſe very minutes, however, it appears, that favourable opportunities of recovery have been ſometimes loſt, owing to want of in-

information in the perſons preſent, with regard to the means that ought to be employed; while the diſtance from medical aid was ſo great, as to render every exertion unſucceſsful by the time that ſuch aſſiſtance could be procured. But although medical men are, from the nature of their ſtudies and profeſſion, particularly qualified for being uſeful on ſuch occaſions, it by no means follows that they are excluſively ſo; on the contrary, repeated experience has ſhewn, that intelligent perſons, of every deſcription, may readily acquire ſufficient information upon the ſubject, to render them the happy inſtruments of recovery.*

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* Mrs. Page, of Hornſey, aſſiſted only by her female ſervants, and following the directions given by the Humane Society, recovered a young girl, who had been taken out of the New River, to all appearance dead. It was fully half an hour before any ſigns of life could be obſerved.—See Reports of the Royal Humane Society, for 1787, 8, and 9,—pages 11, 12, 13.

Mrs. Caddick, of Tipton, in Staffordſhire, alſo recovered a boy who had fallen into a pond near her houſe, after *two hours and a half* aſſiduous employment of the means uſually recommended.—Ibid. p. 312.

Many ſimilar inſtances might be enumerated, but it is hoped that theſe two will be thought a ſufficient proof of what has been advanced above.

It is chiefly with a view to the inſtruction of ſuch perſons, that theſe obſervations have been drawn up, and this circumſtance muſt apologize, if any apology be neceſſary, for the ſtudied rejection of medical words and phraſes, and the preference given to ſuch terms as are familiar to the generality of readers.—Some will no doubt think, that I have gone farther into the matter than was neceſſary in a publication of this nature, and will accordingly expect that I ſhould give my reaſons for treating the ſubject at ſuch length.

It need ſcarcely be ſaid, that whatever concerns the preſervation of human life cannot be too generally known. On no branch connected with the ſcience of medicine, however, is knowledge leſs generally diffuſed, than upon that which makes the ſubject of the following pages; and to this circumſtance only, can we attribute the doubts which we have repeatedly heard profeſſional men expreſs, with regard to the truth of the greater number of caſes where a recovery is ſaid to have been accompliſhed. Without ſome general principles to guide us, we muſt not only truſt for all farther improvement to the uncertainty and danger of random experiment, but we cannot even employ to the beſt advantage, the means which are already known and approved of. To thoſe who are entirely ignorant of ſuch principles, every meaſure recommended muſt appear as of nearly equal importance; whence the moſt trivial may be often employed to the excluſion of thoſe that are abſolutely neceſſary, and to the loſs of much time, if not of the object itſelf for which all the exertions are made. It may be obſerved in proof of this, that inflating the lungs has been long ſpoken of as one of the means that may be tried; but it is only within theſe few years, that it's mode of operation has been clearly ſhewn, and the neceſſity for it's aſſiduous employment properly inſiſted on: and it is, perhaps, to this circumſtance chiefly, that we ſhould attribute the greater proportion of ſucceſsful caſes now than formerly.

To point out the neceſſity for certain meaſures being purſued in preference to others, is the object of the two chapters on *Reſpiration* and *Animal Heat*.—In thus undertaking to ſtrip a profeſſional ſubject of it's technical dreſs, and explain it in ſuch a manner as to be underſtood by thoſe who had never made it any part of their ſtudy, I was not altogether unapprized of the difficulties I had to encounter, and am by no means ſo preſumptuous as to think that I have entirely ſucceeded. For the reaſons which are given above, however, I conſidered the object, if it could be obtained, as of ſufficient importance to warrant the attempt; and relying upon this motive being accepted as an apology, I chearfully ſubmit the performance to the candour and judgment of the publick, at the ſame time expreſſing a hope that my endeavours may not prove altogether without their uſe.

CHAP I.

Of the difference between abſolute and apparent death.

1. IN *apparent* as well as in *abſolute* death, the breathing is at a ſtand,—the heart ceaſes to beat,—no motion is obſervable in any part of the body,—and the perſon is not ſenſible of pain from pinching, pricking, or burning his fleſh.

2. The important difference between the two ſtates is this,—that in *abſolute* death, the vital principle is completely extinguiſhed, whilſt in *apparent* death, it only lies dormant, and may again be rouſed into action, and the perſon thereby completely reſtored to life and health.

3. How long a body will continue in this ſeemingly lifeleſs condition, and yet admit of recovery, has not been preciſely aſcertained. In ſome caſes a recovery is known to have taken place even after interment;* and in others

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* A correſpondent of Dr. Hawes aſſures us, that there is now living in Hertfordſhire, a lady of an ancient and honourable family, whoſe mother was brought to life after interment, by the attempt of a thief to a ſteal a valuable ring from her finger.—*See Reports of the Humane Society for* 1787, 8, 9. *page* 77.

the neceſſary ſteps to embalming the body, though delayed for ſeveral days, have proved that the vital ſpark was not completely deſtroyed but by the knife of the operator.* The caſes of apparent death occaſioned by exceſſive cold, by the various modes of ſuffocation, &c. do not, indeed, afford any example of a recovery after ſo long an interval as that juſt mentioned; yet in many of them, animation was brought about, after having been ſuſpended for *ſeveral hours*, and frequently under the moſt diſcouraging circumſtances, both with regard to the nature of the accident, and the appearances exhibited by the body. It is therefore with good reaſon believed, that, in many caſes, the body retains it's vital principle in a greater or leſs degree, for ſome time after all the outward ſigns of life have diſappeared, and probably does not part with it entirely, ſo long as the vital organs continue of their natural warmth; and conſequently it would appear, that, within this period, the only circumſtance which precludes the poſſibility of a recovery, is, ſuch a degree of injury being done to the brain, heart, or lungs, as renders them incapable of having their proper functions again renewed.

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* "William, Earl of Pembroke *died* ſuddenly April 10th, 1630. When the body was opened in order to be enbalmed, he was obſerved, immediately after the inciſion was made, to lift up his hand." *Granger's Biographical Hiſtory of England, vol. i. p. 330.*

Veſalius the celebrated anatomiſt, who was phyſician to Charles V and to his ſucceſſor Philip II, met with a ſimilar circumſtance, in the caſe of a Spaniſh nobleman whoſe body he was employed to open, in order to diſcover of what diſeaſe he had died. The nobleman's relations repreſented him as a murderer, and it was with difficulty that Philip reſcued him from the Inquiſition, upon condition that he ſhould make a a pilgrimage to Jeruſalem. In returning the ſhip was caſt away on the then deſart iſland of Zante, where the unfortunate Veſalius periſhed from hunger.

4. The importance of this concluſion (the truth of which receives farther confirmation from every day's experience) cannot be too ſtrongly enforced; and the Society entertain the moſt lively hope, that in thus endeavouring to impreſs it on the minds of the public, they may animate the humane and benevolent to uſe every exertion, and not to ceaſe from employing the ſeveral means recommended, until many hours have elapſed, nor ever abandon a a caſe without trial, unleſs indubitable marks of complete and permanent death evidently appear.

5. Various are the appearances which have been pointed out by different writers, as ſigns of the vital principle being completely extinguiſhed; particularly in the caſe of drowned perſons. Thus the cold and rigid ſtate of the

body; the livid and contracted, or the black and ſwoln countenance; the eyes being ſhrunk, dim, and ſhrivelled,—or, prominent, bloodſhot, or glaſſy; the pupils of the eyes being greatly dilated or contracted,—or the one being more ſo than the other,—have all been enumerated, and each in it's turn held as a certain criterion of *abſolute* death.—Farther experience, however, has happily ſhewn, that no one of theſe taken ſingly, nor even ſeveral of them together, can be depended on as infallible,—and that a beginning putrefaction of the body, is perhaps the only unequivocal proof of death we are yet acquainted with in ſuch caſes.

6. But while we thus inſiſt upon the fallacy of the *ordinary* ſigns of death, and ſtrongly inculcate, how neceſſary perſeverance is to ſucceſs, we by no means wiſh to conceal the uncertainty of a happy termination. In every accident requiring ſuch aſſiſtance, circumſtances may have occurred which will render all our exertions fruitleſs. Thus, in the caſe of drowning, the perſon in falling into the water may have ſtruck his head, breaſt, or ſtomach, againſt ſome hard body;—or, owing to the height from which he fell, the ſhock at the ſurface of the water, may alone be ſufficient to deſtroy life entirely. Preceding diſeaſe, intoxication, or expoſure to long-continued

or ſevere cold, will contribute to the ſame fatal effect.

7. It is unneceſſary to particularize all the poſſible circumſtances which may thwart our endeavours; to medical men they will, no doubt, readily occur; and to give a mere catalogue of them, would tend rather to damp, than to animate, the exertions of thoſe who are unacquainted with the nature and effects of ſuch complicated injuries.

8. It is of much greater importance to know, that although the brain, heart, and lungs, remaining ſound, and capable of performing their reſpective functions, is a circumſtance abſolutely neceſſary to the being ſucceſsful,—yet, that a complete recovery has often been effected, in caſes where the marks of bruiſes about the head and breaſt, or the diſcharge of blood from the mouth and noſe, gave great reaſon to fear that ſome of the internal parts had ſuſtained very conſiderable injury.—Far, therefore, from conſidering it as preſumptuous to attempt a recovery under ſuch circumſtancs, let us ever hold in view the poſſibility, that the perſon

—is not dead, but ſleepeth;

and remember, that even an unſucceſsful trial will afford us the heartfelt ſatisfaction of knowing—that we have done our duty.

CHAP. II.

Of the nature and importance of Reſpiration; being an attempt to explain the manner in which a ſtoppage of the breathing, occaſions a ſuſpenſion of life.

9. THE human heart reſembles, in form and ſubſtance, the hearts of ſheep, oxen, &c. Like them alſo, it is divided lengthwiſe by a partition in the middle, ſo as to form two* diſtinct and ſeparate cavities, one of which is ſituated towards the right, and the other towards the left ſide of the body, whence the one is termed the *right*, the other the *left* cavity of the heart. During life theſe two cavities are continually filling and emptying themſelves. Each cavity is ſupplied with blood by large veins that open into it, and contracting as ſoon as full, drives this blood into the great artery that leads from it.†

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* There are, however, *two* diſtinct cavities on *each* ſide of this partition; but as the object is merely to give a general idea of the circulation, we have avoided being minute in the deſcription.

† The ſudden jerk with which the heart contracts and expels the blood into this artery, occaſions that vibratory motion felt in all it's branches, which is termed the *pulſe*, the ſtrokes of which exactly correſpond with the contractions of the heart. As the blood proceeds onwards, and is divided into a greater number of ſtreams, theſe impulſes which it receives from the heart, become leſs and leſs; ſo that in it's return to the heart through the veins, it flows in a regular and equal manner.

10. The great *artery* that ariſes from the left cavity of the heart, divides itſelf into innumerable branches, which are diſtributed over all the body, in order to ſupply the different parts with blood for their nouriſhment and growth. From theſe parts the blood is conveyed back again by *veins*, whoſe branches join with the branches of the arteries, and whoſe trunks terminate in the *right* cavity of the heart.*

11. But although the blood which was ſent out from the heart on one ſide, is thus brought back to it on the other, ſtill it has not completed the circuit round which it moves,—for there is no immediate communication between the two cavities. To get from the *right* cavity to the *left*, therefore, and perform the ſame round as before, the blood muſt firſt paſs through another great artery, the branches of which are diſtributed through the lungs, and join the branches of veins which open into the left cavity of the heart.†

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* Theſe two ſets of veſſels, viz. the arteries and veins, may be compared to two trees which ſpring from the heart as a common root, and are again united to each other at the extremities of their ſmalleſt branches.—In the arteries, the blood moves from the trunk to the branches, whereas in the veins, it moves in the contrary direction, or from the branches to the trunk.

† The courſe which the blood deſcribes in one entire circuit, may be compared to two incomplete circles, a greater and a leſs,

12. The lungs are compoſed of millions of little bladders which communicate with the wind-pipe, and are filled with air every time we inſpire. Upon the ſurfaces of theſe bladders, or air-cells, as they are termed, the ultimate branches of the artery juſt deſcribed (11) and of the correſponding veins, are ſpread out as fine as human hairs; and of courſe, the ſubſtance which is interpoſed between the air contained in the cells of the lungs, and the blood circulating through theſe minute arteries and veins, muſt be extremely thin: It will not be difficult, then, to conceive, that through ſo ſlight an intermedium as this, the air and blood may exert ſome kind of influence upon each other;—and that they actually do ſo, we ſhall now endeavour to prove.

13. The blood, when thrown out by the *left* cavity of the heart, and in it's courſe through all the branches of the great artery leading from thence to the different parts of the body, is of a *bright crimſon* colour, approaching to ſcarlet; but after it has performed

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leſs, joined together as in the figure 8. The greater circle repreſents it's courſe from the *left* cavity of the heart through the *arteries* to the different parts of the body, and from thence thro' the veins back to the *right* cavity: the ſmaller circle repreſents it's courſe from the *right* cavity of the heart, through the lungs, to the *left* cavity, from whence it at firſt ſet out.

it's offices at the parts to which it was ſent, and has paſſed into the veins on it's way back again, the colour is evidently changed to a *red*, which gradually deepens as the blood approaches the heart. In paſſing through the lungs, however, the blood loſes this dark hue entirely, and when arrived at the left cavity of the heart, appears of the ſame *bright crimſon* colour as when there before.

14. But when freſh air is, by any means, prevented from entering the lungs, the blood, inſtead of growing *brighter*, as it did whilſt the breathing went on, becomes gradually *darker*, and at laſt almoſt black: In proportion as the colour deepens, the motion of the *left* cavity of the heart becomes weaker, and in a little time ceaſes entirely,—that of the *right* cavity continuing, though very ſlowly and languidly, for a few ſeconds longer.

15. The heart being now at reſt, the brain is no longer ſupplied with that regular current of blood which enables it to diffuſe life and vigour over the body; the animal, therefore, quickly ſinks into an inſenſible and motionleſs ſtate, and if left to itſelf, gradually becomes quite cold;—with the entire loſs of heat, the heart loſes alſo it's ſenſibility and power of

contraction, and *abſolute death* is the conſequence.

16. If, however, before matters have proceeded ſo far, and particularly, if before the warmth and ſenſibility of the vital parts are much diminiſhed, we alternately inflate and empty the lungs for ſome time, ſo as to imitate the natural breathings,—the blood ſtagnating in them, gradually acquires it's uſual brightneſs of colour;—and as this change goes on, the heart begins to contract, at firſt ſlowly and weakly, but afterwards more frequently and ſtrongly,--the other ſuſpended functions are again renewed, and the animal is at laſt completely reſtored to life.

17. Here then (13--16) we ſee, that as long as the air is freely admitted to the lungs, the blood circulating through them, changes from a *dark red* to a *bright crimſon* colour, and the motion of the heart continues; but that, when the air is excluded, this change no longer takes place, and the heart very ſoon ceaſes to beat. The obvious concluſion is, that the change in the *colour*, depends upon ſome change in the *quality* of the blood, in conſequence of which, it again becomes capable of ſtimulating the *left* cavity of the heart, and exciting it to contraction.

18. Here the queſtion will naturally occur to the reader,—In what does this change conſiſt, and how is it brought about? Is it by the air imparting to the blood, ſomething that is uſeful? or imbibing and carrying off from it, ſomething that is noxious?—or it is well known, that there are certain kinds of air totally unfit for the purpoſe of reſpiration; and that even the ſame portion* of common air, repeatedly breathed, will not ſupport life for more than a few ſeconds.

19. Notwithſtanding what has been ſaid already in the introduction, we think it right to obſerve farther here, that neither extreme minuteneſs, nor ſcrupulous accuracy, are to be expected in the view we are about to give of this curious queſtion; our profeſſed intention being, to treat every part of the ſubject, as far as we are able, in ſuch a way as will beſt explain to thoſe who are not of the medical profeſſion, the reaſons for the ſeveral meaſures to be employed in recovery.

20. Of the modern diſcoveries, by far the moſt important to ſcience in general, and to the ſcience of medicine in particular, are thoſe which concern the nature and varieties of Air.

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* The portion of air here meant, is the quantity which can be taken into the lungs at one inſpiration.

It is now proved, that there are ſeveral kinds of air, and that the common air, or that in which we live, is not, as was long believed, a perfectly ſimple fluid, but a *mixture*, conſiſting of, at leaſt, *two* kinds of air poſſeſſing very different qualities. Methods have been contrived, of ſeparating thoſe airs from each other, and examining them apart,—and the following are their proportions and qualities, according to the lateſt and moſt accurate experiments made for this purpoſe.

21. The firſt kind, and that which conſtitutes, at leaſt, *three-fourths* of the mixture, is found to be in every reſpect the ſame with the air produced by all animal and vegetable ſubſtances during their putrefaction; we ſhall therefore, on the preſent occaſion, diſtinguiſh it by the name of *foul air*.

22. *Foul air* will not allow a candle to burn in it, nor will it ſupport the life of any breathing animal. When applied to blood drawn from a vein, it produces no change in the colour; and when any animal breathes *foul air* only, the blood which has paſſed through the lungs retains it's dark colour, the ſame as when the wind-pipe is cloſed, and no air of any kind allowed to enter.— It is evident, then, that the brightneſs which

takes place in the blood paſſing through the lungs, when common air is breathed, cannot be owing to this ingredient.

23. The ſecond kind of air, which compoſes the remaining *fourth* of the mixture, is derived from various ſources upon the ſurface of the globe, but chiefly from growing vegetables, which produce it in great abundance. A candle burns in this air with a remarkably large and brilliant flame, and an animal ſhut up in a veſſel filled with it, will live *four* times as long as in an equal quantity of *common air*. Theſe properties juſtly entitle it to the names it has received, viz. *pure air*, and *vital air*, and by the latter of theſe we ſhall here denominate it.

24. The reader will, perhaps, be already convinced, that it is to this ingredient of the common air, we muſt attribute the neceſſary change of colour and quality produced in the blood during reſpiration. But what puts it beyond all doubt, is, that if the dark coloured blood drawn from a vein, be received into a phial filled with *vital air*, it immediately loſes it's dark hue, and becomes bright like that which has juſt paſſed through the lungs; and that, when an animal is ſupplied with *vital*

air only, the blood circulating through it's lungs acquires even a greater brightneſs of colour than when *common air* is breathed.

25. Having thus aſcertained that the neceſſary change of the blood in the lungs, is produced by the portion of *vital air* taken in during the breathing; let us next endeavour to determine in what this change conſiſts, and how it is brought about.

26. If a bladder, having a tube or mouth-piece fixed to it, be filled with *common air*, and this air be alternately drawn into the lungs, and thrown back into the bladder,—in a little time a ſenſe of oppreſſion will be felt in the breaſt, which renders it neceſſary to ceaſe from breathing *this*, and take in *freſh* air.

27. Upon examining the air now contained in the bladder, it is found that the quantity of *foul air* remains exactly the ſame as at firſt, but that the whole of the *vital air* has diſappeared, and that it's place is occupied by another kind of air, which, though it differs in many reſpects from *foul air*, yet agrees with it in being totally unfit either to ſupport flame, or to maintain the life of any breathing animal.

28. This new air formed in the lungs, is the ſame with that which is ſeparated in great

quantity from various liquors during their fermentation; alſo from marble, chalk, limeſtone, and ſhells, during their burning into quick lime;—and from it's being known to exiſt previouſly in theſe matters, ſo as to make a part of their ſubſtance, it has received the name of *fixed air.*

29. *Fixed air*, however, has been diſcovered to be a compound fluid, conſiſting of *vital air* intimately combined with a very ſubtile matter called *phlogiſton.* Between thoſe two matters, namely, *vital air* and *phlogiſton*, there exiſts a very ſtrong attraction, inſomuch that when *vital air* comes into contact with any thing that contains *phlogiſton* in a looſe and ſeparable ſtate, the two unite and form *fixed air.*

30. The converſion of *vital air* into *fixed air* during the breathing, muſt therefore (29) depend upon the former meeting and combining with *phlogiſton*; and as it appears (13--26) that at the ſame time that the vital air taken into the lungs thus acquires phlogiſton, the blood paſſing through them loſes it's dark colour, and becomes fit to ſtimulate the *left* cavity of the heart,—the natural concluſion is, that the dark hue and noxious quality of the blood were occaſioned by the preſence of *phlogiſton.*

31. Upon reviewing what has been ſaid in this chapter, it appears, that the nature and purpoſes of *reſpiration* are briefly theſe:—During life a quantity of noxious matter is continually ſeparated from the ſolid parts of the body, and, being imbibed by the blood circulating through them, is carried to it's proper outlet—the lungs: there it meets with *vital air*, for which it has a ſtronger attraction than for the the blood, and uniting with it, is carried off in the form of *fixed air*, leaving the blood pure, and capable of performing it's ſeveral offices as before.

32. *Vital air* will attract only a certain proportion of *phlogiſton*, juſt as we ſee that water will diſſolve only a certain proportion of Salt or Sugar.—The quantity of common air drawn into the lungs at an ordinary breathing, is ſcarcely half a pint, *one-fourth* only of which is *vital air* (23): almoſt the whole of this is inſtantly converted into *fixed air*, and will not then attract any more *phlogiſton*. But as the portion of blood which has been freed from its *phlogiſton* at one breathing, immediately paſſes on to the *left* cavity of the heart, and is ſucceeded by another portion which is equally impregnated with this noxious matter,—it is neceſſary that *vital air* ſhould be regularly taken into the lungs, in order to purify the

ſucceſſive portions of blood as they arrive there;—in other words, the continuance of the breathing is neceſſary to the continuance of life.

33. Much more might be added to illuſtrate and confirm this account of Reſpiration; but we hope that what is here ſaid, will be ſufficient to give our readers a general idea of the matter, —and at the ſame eſtabliſh the following important concluſion;—That in every caſe of *apparent death*, and eſpecially in thoſe caſes occaſioned by a ſtop having been put to the breathing, the inſtituting an artificial reſpiration, by aſſiduouſly inflating the lungs with freſh air, is one of the firſt and moſt neceſſary meaſures to be taken for recovery.

CHAP. III.

Of Animal Heat, and it's connection with Reſpiration.

34. AMONG the circumſtances which diſtinguiſh the living from the dead body, one very remarkable one is, the power poſſeſſed by the former, of maintaining a certain degree of warmth, which is, in moſt inſtances, conſiderably greater than that of the ſurrounding air. The uſe and importance

of this warmth to the living and healthy ſtate, may be inferred from their conſtant connection with each other, and alſo from the wonderful ſteadineſs and regularity with which it is kept up under every change of ſeaſon, and in every variety of climate;—the quickſilver in a thermometer placed under the tongue of a healthy perſon, uniformly pointing to the 98th degree,* whether the experiment be made in ſummer, or in winter, in the ſcorching plains of Africa, or in the frozen regions ſurrounding the poles.

35. Upon the ſubject of *Animal Heat*, as this natural warmth is called, neither the limits nor the intention of this pamphlet, will permit us to be very minute; but, conſiſtency with our plan, we think, requires, that we ſhould attempt to convey to our readers, a general idea, at leaſt, of the matter,—ſuch as we have, in the preceding chapter, endeavoured to give with regard to Reſpiration.—For this purpoſe it will be neceſſary, firſt, to ſtate ſome of the leading and fundamental circumſtances reſpecting heat in general.

36. The word *heat*, in common language, has a double ſignification, being uſed to expreſs both a ſenſation in the mind, and the

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* The ſcale meant here, is that of Fahrenheit, according to which, all the Thermometers uſed in this country are graduated.

unknown principle, whether it be a ſubſtance or a quality, which occaſions that ſenſation. By the term HEAT, however, we wiſh our readers to underſtand that *cauſe* which excites in us the ſenſation of warmth, and which, when operating in a certain degree, produces the various effects of *fire.*

37. An attention to the phenomena which are conſtantly preſenting themſelves to our view, affords convincing proofs that there actually exiſts a principle termed HEAT, or *fire.* With regard to the nature of this principle, two opinions have chiefly prevailed. According to the firſt, HEAT is cauſed by a certain *vibratory motion* of the particles of matter, and it's various degrees depend upon the degrees of this motion. The other opinion is,—that HEAT is neither a quality, nor the effect of any ſtate or condition of matter; but that it is itſelf a *matter* of a very ſubtile nature, and capable of pervading all other bodies; that it exiſts, in a greater or leſs quantity, in every ſubſtance we are yet acquainted with,—and that it can be transferred, to a certain extent, from one body to another. —The firſt, or *mechanical doctrine* of HEAT, aroſe from obſerving, that a very high degree of warmth can be excited by hammering a piece of metal briſkly, and that by the rapid

friction between two pieces of dry wood, even actual fire can be produced. The readineſs with which the production of heat, in many caſes, was explained by this theory, induced philoſophers to extend it to all others; and accordingly it was, at one time, very generally admitted as univerſally true. Of late years, however, this ſubject has been more extenſively and accurately enquired into; and the ſecond, which is termed the *chemical* doctrine of Heat, being found moſt agreeable to facts, has been gradually gaining the aſcendency, and is now held as fully eſtabliſhed.

38. As the language continually uſed with regard to HEAT, by no means correſponds with our preſent ſtate of knowledge upon the ſubject, it will not, perhaps, be amiſs to premiſe a few remarks concerning it.

39. The feelings of men are their firſt, and, in many things, for a long time, their only guides to knowledge. The ſenſations of *warmth* and of *coldneſs* are ſo very diſſimilar, and the preſence of the one is found ſo incompatible with that of the other*, that they were naturally enough conceived to depend upon cauſes altogether different in their nature, and

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* We muſt here be underſtood to mean—*in the ſame part*; for we ſhall immediately ſhew, that oppoſite ſenſations may occur, at the ſame time, in *different parts*.

mutually deſtructive of each other's powers. Thus, whilſt HEAT was admitted as the principle that occaſioned *warmth*,—*coldneſs* was ſuppoſed to proceed from an oppoſite principle, denominated COLD. But the ſenſations which ariſe from impreſſions made upon the ſenſes, differ very much, according to the greater ſtrength or weakneſs of the preceding impreſſions. Hence the ſame ſubſtance will often be pronounced *hot* by one perſon, and *cold* by another; nay, it may be ſo contrived, that the ſame ſubſtance ſhall communicate theſe *oppoſite* ſenſations to the ſame perſon, at the ſame time. —For example—let one hand be immerſed in a veſſel containing water as warm as it can eaſily be borne, and the other in a veſſel containing an equal quantity of water nearly freezing;—if the two waters be then poured together into a third veſſel, and both hands be immediately plunged into the mixture, it will feel hot to the cold hand, and cold to the hot one. Upon the common ſuppoſition, however, that COLD and HEAT are principles both of which have an actual exiſtence, and that their powers are oppoſed to each other, either it muſt happen, that the one or the other will predominate, and the mixture feel hot or cold accordingly,— or, that they will be ſo equally balanced, as to deſtroy each other's powers, and the mixture occaſion neither the ſenſation of warmth nor of cold. But the reſult is conſtantly what we have ſtated it to be, and the concluſion is,—that our *feelings* are inadequate teſts of the truth in this matter, and conſequently, that the language formed upon thoſe feelings is improper, and tends to miſlead.

40. In other caſes, where our *feelings* have been equally the foundation of the terms uſed, no ſuch miſtake has been fallen into, owing to the more obvious exiſtence of the *principles*, concerned. Thus it is univerſally allowed, that the ſtate of light and the ſtate of moiſture, are both occaſioned by the preſence of their reſpective *principles*, namely, LIGHT and WATER. But, notwithſtanding that the ſenſations produced by the ſtates of light and of darkneſs, of moiſture and of dryneſs, are as diſtinct and oppoſite to each other, as the ſenſation ariſing from warmth and that ariſing from coldneſs are, yet it has never been imagined, excepting in a figurative ſenſe*, that *darkneſs* was cauſed by an oppoſite principle to LIGHT, or *dryneſs* by a principle oppoſed to that of *moiſture*. On the contrary, the various degrees of light and of moiſture

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* As in Milton's deſcription of Chaos, where he ſays,
" *Hot*, *cold*, *moiſt*, and *dry*, four champions fierce
" Strive here for maſt'ry."

are uniformly attributed to the preſence of their reſpective principles in correſponding quantities; and the terms *darkneſs* and *dryneſs* merely expreſs ſtates depending upon the *abſence* of thoſe principles, to a greater or leſs degree.

41. The very ſame reaſoning holds true with regard to the terms *warmth* and *coldneſs*; the former really inferring nothing more, than that HEAT is preſent in ſuch quantity as to produce the ſenſation or effect which we diſtinguiſh by that word; and the latter,—that it is ſo far deficient as to occaſion a different ſenſation or effect.

42. Of ſuch extreme ſubtilty is the matter of HEAT, that it has hitherto eluded all the methods thought of for aſcertaining it's quantity by it's bulk or weight; but the property it poſſeſſes of encreaſing the dimenſions of other ſubſtances, has furniſhed us with the means of meaſuring it's *degrees*, with great accuracy, and to a very conſiderable extent. Upon this property of HEAT, the inſtrument called a Thermometer is conſtructed; by the aid of which it is clearly ſhewn, that the ſtates of warmth and of coldneſs depend upon the ſame principle (viz. HEAT) operating in greater or leſs quantity; in other words, that the various degrees of *cold*, are only ſo many *low degrees of heat.*

43. HEAT (and, perhaps, every other matter exiſting) has the property of uniting with matter of a different kind, in ſuch a manner as to have it's moſt ſtriking and characteriſtic qualities completely ſuſpended, and it's preſence rendered no longer manifeſt. When in this fixed and inactive ſtate, it has received the name of *latent* Heat.

44. That any ſubſtance ſhould contain HEAT in very conſiderable quantity, and yet not be *hot*, may appear very ſtrange; an example of the fact, therefore, will probably be the ſhorteſt and moſt ſatisfactory mode of proving it's truth.—If, during very cold weather, equal quantities of ſtrong oil of vitriol, and of water, be put into ſeparate phials, and examined by the Thermometer, neither of them will ſhew that it contains more HEAT than the ſurrounding air does. But let thoſe two fluids be mixed together, and a degree of warmth, nearly equal to that of boiling water, will be immediately produced.—Here, then, from the union of two cold liquors, a great quantity of HEAT becomes ſuddenly obvious to our feelings and the Thermometer. The *cauſe* of this warmth, however, viz. a correſponding quantity of the principle, or matter of heat, muſt have exiſted in one or both of theſe fluids previous to their mixture; but it exiſted in a

fixed, or *latent* ſtate, (i. e. ſo as not to affect the feelings, or the Thermometer) and was ſet at liberty, or rendered *ſenſible*, in conſequence of the two fluids uniting and forming a mixture, whoſe power of fixing and retaining HEAT, is leſs than what the two fluids poſſeſſed while ſeparate.

45. Owing to the property mentioned (43 and 44), different adjuncts to the term HEAT are found neceſſary, accordingly as it is ſpoken of with a reference to the *ſtate* alone, or only to the *quantity*, in which it is preſent in any ſubſtance.

46. Thus, *ſenſible* HEAT, expreſſes this principle in it's looſe and uncombined ſtate, when it's preſence is ſhewn by it's effects upon our feelings, and upon the Thermometer.

47. *Latent* HEAT denotes the principle in it's fixed and combined ſtate, but capable of being evolved in the ſtate of *ſenſible* HEAT, whenever the ſubſtances containing it, have their retaining power leſſened, in conſequence of their uniting with other ſubſtances, as in the example of the oil of vitriol and water, related above (44).

48. *Abſolute* HEAT expreſſes the principle with regard to the *quantity* of it contained in

any ſubſtance, and without any reference to the *ſtate* in which it may be, i. e. without conſidering it either as *latent*, or as *ſenſible* HEAT.

49. The *Temperature* of any ſubſtance, is the degree of *ſenſible* HEAT in that ſubſtance, as meaſured by the Thermometer.

50. HEAT, when in a looſe, or ſenſible ſtate, has a conſtant tendency to diffuſe itſelf equally; ſo that if a body containing any given degree of *ſenſible* HEAT, be placed beſide other bodies that have leſs, the heat continually flows out of the former into the latter, until they all become of an equal *temperature*, or degree of ſenſible heat.*

51. So univerſally is the principle of Heat diffuſed throughout the Univerſe, that we are not yet acqainted with any ſubſtance but what contains more or leſs of it, both in a latent and ſenſible ſtate. The *quantity*, however, and alſo the *proportion*, of HEAT, in either of thoſe ſtates, differ very much in different ſubſtances, and even in the ſame ſubſtance under different circumſtances.

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* From this tendency which *ſenſible* HEAT has, to come to an equilibrium, it has alſo got the name of *moving* HEAT.

52. The air we breathe contains a great deal of *latent* HEAT, even when it's warmth, or *ſenſible* HEAT is very ſmall;† but the pure or *vital* portion of the atmoſphere (23), particularly abounds with it, as is ſhewn by the ſudden increaſe of warmth which takes place whenever *vital air* attracts *phlogiſton* from other bodies; for in that caſe, the *vital air* and the *phlogiſton* unite, and form *fixed air* (29), which cannot retain as much HEAT in a *latent* ſtate, as the *vital air* did before this union; in conſequence of this, a quantity of the *principle* of heat which the *vital air* had held in a fixed ſtate, is ſet at liberty, or converted into moving and ſenſible heat, ſimilar to what happens in the experiment of mixing the oil of vitriol and water (44).

53. The human blood, and the blood of all breathing animals, is alſo capable, under certain circumſtances, of holding a quantity of HEAT in a latent ſtate. Thus, as long as the breathing goes on in the natural manner, the blood, when thrown out from the *left* cavity of the heart, and during it's paſſage through the the arteries leading from thence, is found, by experiment, to contain more *latent* HEAT, than when it has got into the veins in it's way

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† As during froſt and intenſely cold weather.

to the *right* cavity, although it's *temperature*, or degree of *ſenſible* HEAT, is the ſame in both ſituations. It is, moreover, found, that the quantity of *latent* HEAT which the blood has thus parted with in it's progreſs, is in exact proportion to the darkneſs of colour which the blood has acquired. In the preceding chapter, however, we have ſhewn, that the darkneſs of colour depends upon the quantity of *phlogiſton* which the blood has inbibed in it's courſe: the concluſion is, that *phlogiſton* has an effect upon arterial blood, ſimilar to what it has upon *vital air* (51), namely, that of forcing it to part with it's *latent* HEAT in the ſtate of *ſenſible* or *moving* HEAT.

54. The living human body being conſiderably warmer than the air,* and other ſurrounding

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* In ſome few places within or near the tropics, the heat of the air is, at times, equal or ſuperior to that of the human body. This exceſſive heat, however, does not continue long, and it's influence upon the body is conſiderably diminiſhed by the copious perſpiration, and conſequent evaporation of moiſture from the ſkin.—As the production of *cold* (i. e. the diminution of ſenſible heat) by evaporation, is intimately connected with the preſent ſubject, and alſo ſerves to explain many curious facts which it would otherwiſe be impoſſible to comprehend, we ſhall endeavour to give a conciſe view of the principles upon which it is accounted for.

I. It is a matter of common obſervation, that when water is expoſed in any temperature above that of freezing, it gradually flies

ing matters (34), muſt be continually imparting ſome of it's warmth to them (50), and will therefore require a regular ſupply of
HEAT

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flies off in an inviſible vapour; and, that the greater the warmth to which it is expoſed, the faſter does it evaporate.

II. If we pour water upon any heated body, as upon a heated plate of metal, we find that the metal cools much ſooner than it would otherwiſe have done, and this in exact proportion to the quantity of water that evaporates from it's ſurface in a given time.

III. Again, If a thin phial containing water, be kept wetted on the outſide with Æther (which evaporates faſter than any fluid that is yet known), the water within will, in a ſhort time, be ſo far deprived of it's heat as to congeal into ice.

IV. Another proof of the effect of evaporation in carrying off *ſenſible* HEAT, appears in this:—That if water be encloſed in a very thick and ſtrong metal veſſel, whoſe lid is ſcrewed down ſo cloſe that no vapour can eſcape,—and this veſſel be ſet upon the fire, the water within may be made ſo hot as to melt a piece of lead ſuſpended in it,—which requires a degree of heat equal to 540 degrees of Fahrenheit's thermometer: and provided the veſſel could be made ſtrong enough not to burſt from the force with which water expands under very great heats, there is no doubt but the water might be heated equal to red-hot iron.—If, however, inſtead of the lid being ſcrewed down, the top of the veſſel be left quite open, ſo that the ſteam or vapour can fly off readily, the water, from being cold at firſt, will gradually acquire *heat*, until it has received a quantity ſufficient to raiſe the thermometer to the 212th degree; but here it becomes ſtationary, nor will it grow hotter though we increaſe the fire ever ſo much; and the reaſon is, that the *lower* part of the water begins now to be converted into ſteam or vapour, which mounts up to the ſurface in the form of bubbles, and flies off, carrying with it the additional HEAT, as faſt as
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Heat to repair this loſs, and keep it's temperature up to the ſtandard neceſſary for health. We have juſt ſhewn (53), that the blood when ſent

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it paſſes from the fire through the bottom of the veſſel.—The agitation which the ſteam occaſions in the water whilſt aſcending through it, is called *boiling*; and the degree of heat at which it takes place in open veſſels, that have a free communication with the air, is termed the *boiling point.*

V. It appears, then, that the degree to which water can be heated, depends upon the obſtacles which oppoſe the eſcape of the ſteam or vapour; for we have ſhewn (IV), that in cloſe veſſels it can be rendered extremely hot; but that in open veſſels, where the preſſure of the atmoſphere is the only obſtacle to be overcome, it cannot be raiſed above 212 degrees; and if this preſſure alſo, be taken off, by placing the veſſel under the exhauſted receiver of an air-pump, the water will then boil briſkly with a degree of warmth no greater than that of the human body (viz. 98°), and will evaporate faſter than if it had been kept in the open air.—This laſt fact clearly proves, that the only circumſtances neceſſary to evaporation, are, that Heat ſhould be applied, and room given for the ſteam or vapour to expand in, and occupy: of courſe it proves, that although air can diſſolve and ſuſpend a quantity of water, in the ſame way that many fluids can diſſolve and ſuſpend others that are heavier, —yet that air is not neceſſary to the formation of vapour, as is commonly ſuppoſed; and that it's power of diſſolving water, depends chiefly upon it's warmth, i. e. upon the quantity of *ſenſible* Heat which it contains.

VI. The facts mentioned (I. II. III. IV. V.) all ſhew, that when water flies off in the form of ſteam or vapour, it carries with it a great quantity of *ſenſible* Heat; and the operation of diſtilling, in which the Heat and water are again ſeparated from each other, affords us an eaſy method of aſcertaining both the *quantity* and the *ſtate* of the Heat ſo carried off. Thus, it is found, that a pint of water raiſed in ſteam from the boiler of the ſent out from the *left* cavity of the heart, contains a quantity of *latent* Heat, which it gradually parts with in conſequence of imbibing

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the diſtilling apparatus, will, in it's paſſage through the worm, communicate as much Heat to 100 pints of water contained in the worm-tub, as will increaſe it's temperature *eight* degrees. Now, it is evident, that the quantity of the principle or matter of heat, which thus diffuſed over 100 pints of water, renders every part of it *eight* degrees hotter than before, would, if accumulated in *one* pint, raiſe it's temperature no leſs than *eight hundred* degrees,—which is equal to the temperature of red-hot iron. But the temperature, or *ſenſible* Heat, of the ſteam, will by no means account for all this quantity of Heat which is communicated to the water in the worm-tub; for if we ſuſpend a thermometer in the head of the ſtill, or inſert it into the tube leading from thence to the worm, the ſteam paſſing over it will never raiſe the quickſilver higher than the boiling point of water, viz. 212°. The greateſt part of the Heat, then, which the ſteam contains, is in a *latent* ſtate; whence it appears, that ſteam, or vapour, conſiſts of water and *latent* Heat united together.

We can now eaſily account for the great quantity of *ſenſible* Heat which diſappears during evaporation, as we here ſee that it is converted into *latent* heat, and forms one of the component parts of the ſteam or vapour.

The cooling power of evaporation ſeems to be practically known to the inhabitants of moſt warm countries, and has long been employed by the natives of India, for a variety of purpoſes, and among others, for that of procuring one of their greateſt luxuries. A number of ſhallow pans, made of a very porous earth, and filled about an inch deep with water, are placed, during the night, in an expoſed ſituation where there is a free circulation of air. The water tranſuding through the pores of theſe veſſels, keeps their bottom and ſides conſtantly wet; and the evaporation from thence, and from the ſurface of the *phlogiſton* during it's progreſs;—and hence it appears, that the blood is the immediate ſource from whence the body is furniſhed with that regular ſupply of HEAT which it conſtantly requires.

55. The quantity of *latent* HEAT which is contained in the blood whilſt circulating in the

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the water, occaſions a degree of cold ſufficient to form a thin plate of *ice* in each pan before morning.—It is alſo a practice in India, to ſprinkle the floors with roſe-water, and to hang up before the doors of the apartments, thin ſcreens made of ſweet-ſmelling graſs, which are kept conſtantly wetted by perſons ſtationed there for the purpoſe. By means of this contrivance, the rich and luxurious European Nabob ſeated within, enjoys the grateful coolneſs of his native climate during the intenſe heats of a Bengal ſummer, when the thermometer frequently ſtands many degrees above the temperature of the human blood. Perſons who cannot afford this expence, would inevitably ſink under the effects of the heat at thoſe times, were it not for the increaſe of perſpiration which then takes place, the evaporation of which from the ſkin, aſſiſts in keeping the body at it's proper and healthy temperature.

The principles delivered above, afford a ready ſolution to theſe, and to many other circumſtances where evaporation is concerned;—as why perſons who are ſhipwrecked, may periſh from cold in a few hours by being expoſed to the ſpray of the ſea, although the air at the time be moderate in it's temperature;—alſo why one feels leſs chilly and cold upon coming out of ſalt, than out of freſh water, at the ſame temperature, (the former not evaporating ſo faſt as the latter);—they alſo explain the ſudden and dangerous cooling of the body that frequently follows the wearing damp or wet clothes, lying in damp ſheets, or ſitting in rooms newly waſhed; together with many other occurrences which obſervation and experience will ſuggeſt to the reader.

the arteries (53), is not very conſiderable, and nearly the whole of it is ſet at liberty by the time the blood has got to the *right* cavity of the heart; but as the blood upon it's arriving here, is immediately tranſmitted through the lungs to the *left* cavity of the heart again, in order to be from thence diſtributed over all the body, and ſupply the different parts with warmth as before,—it is obvious, that to fit it for performing this office anew, it muſt firſt receive a freſh ſupply of the principle of heat. Accordingly, we find by experiment, that after the blood has paſſed through the lungs, and got to the *left* cavity of the heart, it has actually regained as much *latent* HEAT as it had given out in it's progreſs through the reſt of the body.—It only remains then, to ſhew the ſource from whence the blood derives this freſh ſupply of HEAT, and to explain in what manner the buſineſs is performed.

56. As the blood was forced to give out it's *latent* HEAT in conſequence of having imbibed *phlogiſton*, it is plain that in order to acquire *latent* HEAT again, it muſt firſt part with this *phlogiſton* to ſomething elſe. Now we have already ſeen (30), that the blood in paſſing thro' the lungs gives out the *phlogiſton* it contained, to the *vital air* drawn in at each breathing; and we have likewiſe ſeen (52), that when

phlogiſton unites with *vital air*, a quantity of HEAT is immediately evolved. As the *vital air*, then, which is taken into the lungs, meets and unites with *phlogiſton* there, a quantity of HEAT is ſet at liberty, at the very moment that the blood, by parting with this *phlogiſton*, has recovered the power of acquiring more HEAT, and retaining it in a *latent* ſtate: the conſequence is, that the blood now abſorbs and fixes a quantity of this principle, equal to what it had given out in the former part of it's courſe, and thereby becomes fitted to perform the important office of ſupplying the body with warmth as before.

57. After having thus gone through in detail, the ſeveral ſteps of this admirable contrivance, by means of which the living body is enabled to maintain a degree of warmth conſiderably greater than that of the ſurrounding air, the reader will, no doubt, wiſh to ſee the the whole ſummed up in one ſhort and comprehenſive view.

58. From what has been ſaid, then, it appears,—that during the breathing, *pure* or *vital air* is regularly taken into the lungs, where it meets with the blood returned from the different parts of the body, and deprived of it's *latent* HEAT by having imbibed *phlogiſton*: the *vital*

air having a ſtronger attraction for *phlogiſton* than the blood has, immediately unites with it, and at the ſame time gives out a quantity of HEAT, which the blood (whoſe capacity for acquiring *latent* HEAT again, is reſtored by parting with this *phlogiſton*) inſtantly abſorbs, and carries along with it into the courſe of the circulation, to be there evolved, and diffuſed over every part of the body. In ſhort, the generation, as it is called, of *Animal Heat* conſiſts in an alternate double exchange of principles,—the blood in the lungs conſtantly diſcharging PHLOGISTON and abſorbing HEAT, while in the reſt of it's courſe it imbibes PHLOGISTON and ſets this HEAT at liberty.

59. We now come to a moſt important part of our ſubject, namely, the application of this theory of *Animal Heat*, to the purpoſe of reſuſcitation.

60. As a certain degree of warmth is uniformly preſent while the living functions continue, and as experience has ſhewn that theſe functions are ſuſpended or deſtroyed by any thing that greatly diminiſhes this warmth,—it was very naturally concluded, that to reſtore warmth to the body, was one of the moſt *neceſſary*, and, therefore, ought to be one of the *firſt* ſteps taken, in every caſe of ſuſpended animation. Agreeably to this opinion, it has,

until very lately, been the uniform practice on ſuch occaſions, to endeavour, firſt, to reſtore the loſt warmth by the application of heat to the ſurface of the body; and to poſtpone almoſt every other means until this was accompliſhed. But admitting that the preſence of a certain degree of warmth, which we have ſhewn to be the *effect* of ſome, is alſo, in it's turn, the *cauſe* of other, functions neceſſary to life,—and, therefore, that in all caſes where the heat of the body is greatly reduced, the reſtoration of it by external heat may be proper,—yet we think it evidently appears from what has been ſaid in this and the preceding chapter, that, when reſpiration and circulation are completely ſuſpended, the merely reſtoring heat to the body, will not renew *all* the functions neceſſary to life; and farther, that inſtituting an artificial breathing in the way hereafter directed, and thereby renewing the motion of the heart, and the proceſs of *Animal Heat*, is by far the moſt effectual method of reſtoring both warmth and life to the body, and, conſequently, ſhould not be poſtponed for a moment after it can be put into execution. We know that a maſs of matter placed in air or water hotter than itſelf, acquires HEAT ſlowly, in proportion to the quantity of matter in the maſs, and the ſmallneſs of it's ſurface. Now the human body, which contains a great quantity of matter under a ſurface ſmall in proportion, will, even when cooled but a little below it's natural temperature, require a conſiderable time to have that temperature reſtored by means of heat applied to the ſurface. But as every part of the body, from the centre to the ſurface, is penetrated by innumerable arteries and veins through which the blood circulates, it is evident, that if the blood, which ſtagnates in the lungs in caſes of ſuſpended animation, be ſupplied with HEAT (56), and the heart be again put in motion (13), the blood containing this HEAT will be quickly diſtributed through every part of the body, and the natural warmth be thereby reſtored in much leſs time than by any other mode.

61. It is only, however, againſt the application of external warmth, when it tends to poſtpone the other and more effectual meaſures for recovery, that we here object; for we ſhall by and by ſhew, how it may be employed without interfering with them,—as we believe, that when uſed with judgment, it is highly ſerviceable, by reſtoring to the ſkin the ſenſibility it had loſt from being deprived of it's heat,—and thereby, perhaps, reſtoring ſenſibility to the ſtomach, and other important internal parts, in conſequence of the ſympathy or connection ſubſiſting between the condition of thoſe parts

and that of the ſkin,—a connection which phyſicians daily ſee and acknowledge, but cannot explain.

62. We ſhall now cloſe this, as we did the preceding chapter, by drawing a practical concluſion, which we truſt will appear fairly deducible from the ſeveral premiſes; it is,—That in every caſe of *apparent death*, the inſtituting an artificial breathing, by aſſiduouſly inflating the lungs with freſh air, is one of the firſt and moſt neceſſary meaſures to be taken for recovery.

CHAP. IV.

Of apparent death from drowning, and the means to be employed for recovery.

63. FROM conſidering that a drowning perſon is ſurrounded by water inſtead of air, and that in this ſituation he makes ſtrong and repeated efforts to breathe, we ſhould expect that the water would enter and completely fill the lungs. This opinion, indeed, was once very general, and it ſtill continues to prevail among the common people. Experience, however, has ſhewn, that unleſs

the body lies ſo long in the water as to have it's living principle entirely deſtroyed, the quantity of fluid preſent in the lungs is inconſiderable; and it would ſeem that ſome of this is the natural moiſture of the part accumulated, for upon drowning kittens, puppies, &c. in ink, or other coloured liquors, and afterwards examining the lungs, it is found that very little of the coloured liquor has gained admittance into them.—To explain the reaſon why the lungs of drowned animals are ſo free from water, it is neceſſary to obſerve, that the muſcles which form the opening into the wind-pipe, are exquiſitely ſenſible, and contract violently upon the leaſt irritation, as we frequently experience when any part of the food or drink happens to touch them. In the efforts made by a drowning perſon, or animal, to draw in air, the water ruſhes into the mouth and throat, and is applied to theſe muſcles, which immediately contract in ſuch a manner as to ſhut up the paſſage into the lungs.* This contracted ſtate continues as long as the muſcles retain the principle of life, upon which the power of muſcular contraction de-

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* And to this circumſtance it is ſometimes owing, that the air blown into the noſtril in order to inflate the lungs, cannot enter the wind-pipe; in conſequence of which another mode of inflation becomes neceſſary.

pends; when that is gone, they become relaxed, and the water enters the wind-pipe and completely fills it.

64. On diſſecting the body of a recently drowned animal, no particular fulneſs of the veſſels within the ſkull, nor any diſeaſe of the brain or it's membranes, are viſible.

65. The lungs alſo are ſound, and the branches of the wind-pipe generally contain more or leſs of a frothy matter, conſiſting chiefly of air, mixed with a ſmall quantity of a colourleſs fluid.

66. The *right* cavity of the heart, and the trunks of the large internal veins which open into it, and alſo the trunk and larger branches of the artery which carries the blood from this cavity through the lungs,—are all diſtended with dark coloured blood, approaching almoſt to blackneſs. The *left* cavity of the heart, on the contrary, is nearly or entirely empty, as are likewiſe the large veins of the lungs which ſupply it with blood, and the trunk and principal branches of the great artery which conveys the blood from hence to the various parts of the body.

67. The external blood-veſſels are empty; and the fleſhy parts are as pale as if the animal had been bled to death

68. When a body has lain in the water for ſome time, other appearances will alſo be obſervable,—ſuch as, the ſkin livid, the eyes bloodſhot, and the countenance bloated and ſwoln; but theſe appearances, though certainly unfavourable, do not abſolutely prove that life is irrecoverably gone (5).

69. It appears then (64—67), that in the caſe of drowning, no injury is done to any of the parts eſſential to life; but that the *right* cavity of the heart, together with the veins and arteries leading to and from that cavity, are turgid with blood, whilſt every other part is almoſt drained of this fluid.

70. From (63 & 65) we ſee, that the practice of holding up the bodies of drowned perſons by the heels, or rolling them over a caſk, is unneceſſary; the lungs not being filled with any thing that can be evacuated in this way.* But from (66) we ſee farther, that ſuch a practice

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* In general, the water diſcharged from the mouth by this treatment, comes from the parts about the throat. When the quantity, however, is conſiderable, the greater part muſt have come from the ſtomach. But although a quantity of water lodged in the ſtomach, will prevent the lungs from expanding to their utmoſt, it appears to have no other bad effect; and it is better to proceed under this diſadvantage, than riſque the conſequences which will probably attend the degree of violence that is neceſſary to get rid of it.

is highly dangerous, as the violence attending it, may readily burſt ſome of thoſe veſſels which are already overcharged with blood, and thus convert what was only ſuſpended animation, into abſolute and permanent death.

71. The operation of inflating the lungs, is a perfectly ſafe, and much more effectual method of removing any frothy matter they may contain; and whilſt it promotes the paſſage of the blood through them, alſo renders it capable of ſtimulating the *left* cavity of the heart, and exciting it to contraction (16).

72. As ſoon as the body is taken out of the water, it ſhould be ſtripped of any clothes it may have on, and be immediately well dried.* It ſhould then be wrapped in dry warm blankets, or in the ſpare clothes taken from ſome of the by-ſtanders, and be removed as quickly as poſſible to the neareſt houſe that can be got convenient for the purpoſe:† the fitteſt

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* The propriety of this ſtep will appear from what has been ſaid reſpecting the cooling effects of evaporation, in the note, pages 28—9, &c.; for it is certain, that the internal parts retain a degree of warmth for ſome time after the accident; but theſe parts will ſoon be deprived of this, and of their ſenſibility alſo, if evaporation be allowed to go on from the ſurface of the body.

† Should the accident happen at a conſiderable diſtance from any houſe, much time may be loſt in tranſporting the body thither.

will be one that has a tolerably large apartment, in which a fire is ready, or can be made.

73. The body may be carried in men's arms, or laid upon a door; or, in caſe the houſe be at a diſtance from the place, if a cart can be procured, let the body be placed in it, on one ſide, upon ſome ſtraw, with the head and upper parts ſomewhat raiſed; and in this poſition, a briſk motion will do no harm.—Whatever be the mode of conveyance adopted, particular care ſhould be taken, that the head be neither ſuffered to hang backwards, nor to bend down with the chin upon the breaſt.

74. When arrived at the houſe, lay the body on a mattreſs, or a doubled blanket, ſpread upon a low table, or upon a door ſupported by ſtools; the head and cheſt being elevated by pillows.

75. As the air of a room is very ſoon rendered impure by a number of people breathing in it,*—for this reaſon, as well as to avoid the confuſion and embarraſſment attending

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thither. Therefore, if the weather happen to be warm, and the ſun to ſhine out ſtrongly, the body may be laid on ſome dry clothes, and expoſed to the ſun's rays, to reſtore it's heat, whilſt the other neceſſary ſteps are taken for promoting recovery.

* If the weather will permit it, the windows of the room ſhould be kept open.

ing a crowd, no more perſons ſhould be admitted into the apartment where the body is placed, than are neceſſary to aſſiſt immediately in the recovery : in general, *ſix* will be found ſufficient for this purpoſe, and theſe ſhould be the moſt active and intelligent of the by-ſtanders.

76. It will be found moſt convenient to divide the aſſiſtants into two ſets, one ſet being employed in reſtoring the heat of the body, while the other inſtitutes an artificial breathing in the following manner.

77. An aſſiſtant taking his ſtation at the head of the drowned body, is to introduce the ſmall end of the wooden tube,* Fig. 3. (ſee the plate), into either noſtril, and ſuſtain it there with the right hand, whilſt, with the left, he accurately cloſes the other noſtril and mouth. A *ſecond* aſſiſtant placed on the *left* ſide of the body, muſt now endeavour to inflate the lungs, by inſerting the pipe of a pair of common bellows, into the wide end of the wooden tube, and blowing with ſufficient force

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* Where the wooden tube is not at hand, it's place may be tolerably well ſupplied by means of a card, or a piece of ſtiff paper or leather, rolled up in the ſhape of a funnel, and tied with a piece of pack-thread; and in defect of bellows, an aſſiſtant ſhould try to inflate the lungs by blowing into the noſtril, through ſuch a tube, or through a reed, quill, or other ſmall pipe, with his breath.

ſorce to raiſe the cheſt. To prevent any air from paſſing down the gullet, and ſo getting into the ſtomach, a *third* aſſiſtant, ſtationed on the *right* ſide of the body, ſhould preſs the upper part of the wind-pipe gently backwards* with his *left* hand, keeping his *right* hand lightly ſpread out upon the breaſt. As ſoon as the lungs are filled with air, the *firſt* aſſiſtant is to unſtop the mouth, and the third to expel the air again, by preſſing moderately on the breaſt. The ſame operation is to be repeated in a regular and ſteady manner, until natural reſpiration begins, or until this, and the other meaſures have been perſiſted in for at leaſt *ſix hours*, without any appearance of returning life.

77. Very often the firſt attempts to inflate the lungs in this way, do not ſucceed. When that is the caſe, let an aſſiſtant, by means of his finger introduced into the throat, depreſs and draw forwards the tongue, and then, with a piece of ſponge, or a corner of a towel, re-

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* We know from repeated trials made upon the dead body, that unleſs this precaution be attended to, the air blown into the noſtril will paſs into the ſtomach much more readily than into the lungs; nor is it at all improbable, that perſons who are not of the medical profeſſion, and who, of courſe, are not aware of this circumſtance, may have ſometimes failed in their endeavours, in conſequence of inflating the ſtomach inſtead of the lungs.

move any frothy matter that may be lodged about the upper part of the wind-pipe.

78. Should it ſtill be found, that the air does not paſs readily into the lungs, immediate recourſe muſt be had to another and more effectual method for attaining that object. As this method, however, requires addreſs, and alſo ſome knowledge of the parts about the throat, we would recommend that when there is not a medical gentlemen preſent, the mode already deſcribed, be tried repeatedly before this be attempted.

79. Having procured the caſe of inſtruments from the place where they are lodged, the moſt dexterous of the aſſiſtants is to paſs the fore finger of his left hand, as far into the throat as he can, and along this direct the end (A), of the flexible tube, Fig. 5. puſhing it gently onwards until it appears to have got ſome length into the paſſage leading to the ſtomach. The ivory ſliding piece (B), is then to be moved along the tube as far as the finger will reach, ſo as to plug up the opening into the gullet, and thereby prevent any air from getting into the ſtomach, as well as any miſ-direction of the next inſtrument.

80. The end of the flexible tube may be allowed to hang out of the *right* corner of the

mouth, where it will be leaſt in the way of the aſſiſtant, who is now again to introduce the fore finger of his left hand, and with it depreſs and draw forward the root of the tongue. Then taking the Canula, or curved ſilver tube, (Fig. 1), in his right hand, let him direct the flat point of it along this finger, towards the left almond of the ear, and between that and the ſide of the tongue. Having in this way got the point of the Canula *beyond* the root of the tongue, he ſhould gently turn the inſtrument in his hand, and ſlowly raiſe the end which he has hold of, ſo that the point may rather fall than be puſhed into the opening of the wind-pipe.

81. This being done, the mouth-piece, (Fig. 7), for receiving the nozzle of the bellows, is to be fixed on the end of the Canula; and the noſtrils and mouth being accurately cloſed by the aſſiſtant who ſuſtains the Canula in it's ſituation, the operation of inflating the lungs is to be renewed.—In the preſent method, there is no occaſion to preſs the upper part of the wind-pipe backwards, in order to cloſe the gullet; that paſſage being completely ſtopped by the ivory ſliding piece.—To let the air paſs out, when preſſure is made upon the breaſt, the nozzle of the bellows muſt be drawn back a little in the mouth-piece, and

inſerted again when the lungs are to be inflated: on this account the ſitting poſture will be found moſt convenient for the the aſſiſtant who manages the bellows, as by reſting them on his knee, he can draw the nozzle back or thruſt it forwards in the mouth-piece without diſturbing the Canula.*

81. As a quantity of frothy matter occupying the branches of the wind-pipe (65) and preventing the entrance of the air into the lungs, is generally the circumſtance which renders this mode of inflation neceſſary, the mouth ſhould be opened from time to time to remove this matter as it is diſcharged.

82. While one ſet of the aſſiſtants are thus engaged in performing artificial reſpiration, the

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* Should it unfortunately happen, that the lungs cannot be inflated in the manner deſcribed in par. 75, and that the jaws are ſo firmly locked as to render the introduction of the Canula impracticable, the only reſource left, is, to perform the operation of Bronchotomy; which ſhould certainly be done rather than abandon the ſufferer to his otherwiſe inevitable fate. This operation conſiſts in making a longitudinal inciſion, of about an inch in length, through the ſkin, ſo as to lay bare that portion of the wind-pipe immediately below the protuberance which appears in the fore part of the neck; a tranſverſe opening is then made between the rings of the wind-pipe, juſt large enough to admit the point of the ſilver Canula, through which the air muſt be blown, and the lungs inflated. It is ſcarcely neceſſary to add, that this cannot be done properly but by a medical perſon.

other ſhould be employed in communicating heat to the body.—The warm bath has been uſually recommended for this purpoſe; but, wrapping the body in blankets, or woollen cloths, ſtrongly wrung out of warm water, and renewing them as they grow cool, beſides being a ſpeedier† and more practicable‡ method of of imparting heat, has this great advantage, that it admits of the operation of inflating the lungs being carried on without interruption.

83. Until a ſufficient quantity of warm water can be got ready, other methods of reſtoring warmth may be employed; ſuch as the application of dry warm blankets round the body and limbs; bags of warm grains or ſand, bladders or bottles of hot water, or hot bricks applied to the hands, feet, and under the arm-pits,—the bottles and bricks being covered with flannel: or the body may be placed before the fire, or in the ſunſhine if ſtrong at the time,

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† This fact is well aſcertained; and what has been ſaid (Note * p. 28) reſpecting the great power of ſteam in communicating heat, will aſſiſt in explaining the reaſon of it.

‡ To employ the warm bath with any tolerable degree of convenience, requires a tub made for the purpoſe, which cannot always be had; and likewiſe a much greater quantity of water than can generally be got ready in a ſhort time.

and be gently§ rubbed by the aſſiſtants with their warm hands, or with cloths heated at the fire or by a warming pan.

84. The reſtoration of heat ſhould always be gradual, and the warmth applied ought never to be greater than can be comfortably borne by the aſſiſtants. If the weather happen to be cold, and eſpecially if the body has been expoſed to it for ſome time, heat ſhould be applied in a very low degree at firſt: and if the weather be under the freezing point, and the body when ſtripped, feel cold and nearly in the ſame condition with one that is frozen, it will be neceſſary at firſt to rub it well with ſnow, or waſh it with cold water; the ſudden application of heat in ſuch caſes, having been found very pernicious. In a ſhort time, however, warmth muſt be gradually applied.

85. To aſſiſt in rouſing the activity of the vital principle, it has been cuſtomary to apply various ſtimulating matters to different parts of the body. But as ſome of theſe applications are in themſelves hurtful, and the others ſer-

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§ The frictions ſhould at firſt be very gentle, and performed with a view to reſtore heat, and not to force the blood towards the heart, which in drowned perſons is already too much diſtended with it (66). After the inflation has been continued for ſome time, ſtronger frictions may be employed.

viceable only according to the time and manner of their employment, it will be proper to conſider them particularly.

86. The application of all ſuch matters in caſes of apparent death, is founded upon the ſuppoſition that the ſkin ſtill retains ſenſibility enough to be affected by them. It is well known, however, that, even during life, the ſkin loſes ſenſibility in proportion as it is deprived of heat, and does not recover it again until the natural degree of warmth be reſtored. Previous to the reſtoration of heat, therefore, to a drowned body, all ſtimulating applications are uſeleſs, and ſo far as they interfere with the other meaſures, are alſo prejudicial.

87. The practice of rubbing the body with ſalt or ſpirits, is now juſtly condemned. The ſalt quickly frets the ſkin, and has in ſome caſes produced ſores, which were very painful and difficult to heal after recovery. Spirits of all kinds evaporate faſt, and thereby, inſtead of creating warmth, as they are expected to do, carry off a great deal of heat from the body.† Spirit of Hartſhorn, or of Sal Volatile, are liable to the ſame objection as brandy or other diſtilled ſpirits, and are beſides very diſtreſſing

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† The reaſon of their doing ſo has been already ſhewn in Note *, p. 28,

to the eyes of the aſſiſtants. When there is reaſon to think that the ſkin has, in any degree, recovered it's ſenſibility, let an aſſiſtant moiſten his hand with Spirit of Hartſhorn, or *Eau de Luce*, and hold it cloſely applied to one part: in this way evaporation is prevented, and the full ſtimulant effect of the application obtained. A liniment compoſed of equal parts of Spirit of Hartſhorn and ſallad oil, well ſhaken together, would appear to be ſufficiently ſtimulating for the purpoſe, and as it evaporates very ſlowly, will admit of being rubbed on without producing cold.—The places to which ſuch remedies are uſually applied, are, the wriſts, ancles, temples, and the parts oppoſite the ſtomach and heart.

88. The inteſtines, from their internal ſituation and peculiar conſtitution, retain their irritability longer than the other parts of the body, and, accordingly, various means have been propoſed for increaſing the action of their fibres, in order to reſtore the activity of the whole ſyſtem. Tobacco-ſmoke, injected by way of glyſter, is what has been generally employed with this view, and the *fumigator*, or inſtrument for adminiſtering it, makes a part of the apparatus which is at preſent diſtributed by the different ſocieties eſtabliſhed for the recovery of drowned perſons.

Of late, however, the uſe of tobacco-ſmoke has been objected to, and upon very ſtrong grounds; for when we conſider that the ſame remedy is ſucceſsfully employed with the very oppoſite intention, namely, that of leſſening the power of contraction in the muſcles, and occaſioning the greateſt relaxation conſiſtent with life, it muſt be acknowledged to be a very doubtful, if not dangerous remedy, where the powers of life are already nearly exhauſted.†

89. Inſtead of tobacco-ſmoke then, we would recommend a glyſter, conſiſting of a pint or more of water, moderately warmed,

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† Tobacco-ſmoke injected into the inteſtines of a living perſon, brings on great anxiety, diſtreſſing ſickneſs, violent retchings, cold ſweats, faintings, and ſometimes even death itſelf. Hence, when uſed with caution, it has been found one of the moſt effectual means for relaxing the whole muſcles of the body, and favouring the attempts of the ſurgeon to reduce dangerous ruptures. Theſe effects ſeem to depend upon an eſſential oil, which the tobacco contains in conſiderable quantity, and which is raiſed in the form of vapour when the tobacco is burnt: ſo powerful is this eſſential oil when collected, that a ſmall quantity applied to wounds, completely palſied the limbs of ſeveral animals upon which the experiment was made. *(See the Abbe Fontana's Experiments on Poiſons).* What then muſt we ſuppoſe to be the conſequence of applying to the ſurface of the inteſtines, the eſſential oil contained in ſeveral ounces of tobacco? for ſo much, we are well aſſured, has been often burnt in the fumigator, in unſucceſsful attempts to recover perſons apparently dead.

with the addition of one or two table ſpoonfuls of Spirit of Hartſhorn, a heaped tea ſpoonful of ſtrong muſtard, or a table ſpoonful of Eſſence of Peppermint: in defect of one or other of theſe, half a gill or more, of rum, brandy, or gin, may be added, or the warm water given alone.—This ſtep, however, need not be taken, until artificial reſpiration has been begun;—for it will anſwer but little purpoſe to ſtimulate the heart through the medium of the inteſtines, unleſs we, at the ſame time, ſupply the left cavity with blood fitted to act upon it; which we cannot do without firſt removing the collapſed ſtate of the lungs, and promoting the paſſage of the blood thro' them by a regular inflation (16).

90. As the ſtomach is a highly ſenſible part, and intimately connected with the heart and brain, the introduction of ſome moderately warm and ſtimulating liquor into it, ſeems well calculated to rouſe the dormant powers of life. This is very conveniently done by means of the ſyringe and flexible tube (Fig. 4 and 5 of the plate). The quantity of fluid thrown in, ought not to exceed half a pint, and may be either warm negus, or water with the addition of one or other of the ſtimulating matters recommended above (89),—uſing,

however, only half the quantities mentioned there.*

91. As ſoon as the pulſe or beating of the heart can be felt, the inſide of the noſtrils may be occaſionally touched with a feather dipt in Spirit of Hartſhorn, or ſharp muſtard; it being found by experience, that any irritation given to the noſe, has conſiderable influence in exciting the action of the muſcles concerned in reſpiration.†

92. When the natural breathing commences, the flexible tube and Canula ſhould be withdrawn, and any farther inflation that may be neceſſary, performed by blowing into the noſtril in the manner firſt deſcribed (77, p. 44).

93. Letting blood has been generally thought requiſite in every caſe of ſuſpended animation. The practice, however, does not appear to have been founded upon any rational principle

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[*] It will be dangerous to attempt getting fluids down the throat in any other way, until the power of ſwallowing is pretty well reſtored.—Where Æther, or Hoffman's Anodyne Liquor, can be had, one tea ſpoonful of the former, or two of the latter, will be a very uſeful addition to the water, inſtead of the remedies enumerated above.

[†] Some recommend the blowing a pinch of ſnuff or pepper up the noſe. The pepper may certainly be uſed both with ſafety and advantage; but the ſnuff, if it ſhould get back into the throat, and be ſwallowed when recovery takes place, may bring on great ſickneſs and diſorder.

at firſt, and it has been continued from the force of cuſtom, rather than from any experience of it's good effects. In the caſe of drowned perſons, there is not, as in thoſe who ſuffer from hanging or apoplexy, any unuſual fulneſs of the veſſels of the brain ; and the quantity of blood that can be drawn from the external veins (67), will not ſenſibly diminiſh the accumulation of it in thoſe near the heart. Beſides, bloodletting, which always tends to *leſſen* the action of the heart and arteries in the living body, cannot be ſuppoſed to have a directly oppoſite effect in caſes of apparent death ; on the contrary, if employed here, it will hazard the entire deſtruction of thoſe feeble powers which yet remain, and to increaſe and ſupport which all our endeavours ſhould be directed.

94. When the ſeveral meaſures recommended above, have been ſteadily purſued for an hour or more, without any appearance of returning life, Electricity ſhould be tried ; experience having ſhewn it to be one of the moſt powerful ſtimuli yet known, and capable of exciting contraction in the heart and other muſcles of the body, after every other ſtimulus had ceaſed to produce the leaſt effect. Moderate ſhocks* are found to anſwer beſt, and

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* Such are thoſe from a jar of twenty-four inches, or thirty inches

theſe ſhould, at intervals, be paſſed through the cheſt in different directions, in order, if poſſible, to rouſe the heart to act. Shocks may likewiſe be ſent through the limbs, and along the ſpine; but we are doubtful how far it is ſafe or uſeful, to paſs them through the brain, as ſome have recommended. The body may be conveniently inſulated, by placing it on a door ſupported by a number of quart bottles, whoſe ſides are previouſly wiped with a towel, to remove any moiſture they may have contracted.—By experiments made on different animals, it is found, that the blood paſſes through the lungs moſt readily when they are fully diſtended with air; conſequently, that if the lungs of a drowned perſon are inflated, and kept in the expanded ſtate whilſt the electric ſhock is paſſed through the cheſt, the blood accumulated in the *right* cavity of the heart and it's veſſels, will move forward without any reſiſtance, ſhould the heart be brought to contract upon it. As ſoon as the ſhock is given, let the lungs be emptied of the air they contain, and filled again with freſh air; then paſs another ſhock,—and repeat this

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inches coated ſurface, and the diſcharging electrometer placed about one-third or half an inch from the knob of the jar, or from the prime conductor, accordingly as it is applied to one or the other in the machine uſed.

until the heart is brought into action, or until it appear that all farther attempts are uſeleſs.—In order more certainly to paſs the ſhock through the heart, place the knob of one diſcharging rod above the collar-bone of the right ſide, and the knob of the other above the ſhort ribs of the left: the poſition of the diſcharging rods, however, may be changed occaſionally, ſo as to vary the direction of the ſhock.—Two thick braſs wires, each about eighteen inches long, paſſed through the two glaſs tubes, or wooden caſes well varniſhed, and having at one end a knob, and at the other a ring to faſten the braſs chain to,—form very convenient diſcharging rods; and by means of them, the ſhock may be adminiſtered without the riſque of it's being communicated to the aſſiſtants, or carried off by the ſkin being wet.†

95. When the patient is ſo far recovered as to be able to ſwallow, he ſhould be put into a warm bed, with his head and ſhoulders ſomewhat raiſed by means of pillows. Plenty of

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† We have thought it unneceſſary to be more particular upon the employment of electricity, as thoſe perſons who are already acquainted with the uſe of an electrical apparatus, do not require minute inſtructions; and to thoſe who are altogether ignorant of the matter, no information that we could give here, would be ſufficient for the purpoſe.

warm wine-whey, ale-poſſet, or other light and moderately nouriſhing drink, ſhould now be given; and gentle ſweating promoted, by wrapping the feet and legs in flannels well wrung out of hot water.

96. If the ſtomach and bowels feel diſtended and uneaſy, a glyſter, conſiſting of a pint of warm water, with a table ſpoonful of common Salt, or an ounce or more of Glauber's or Epſom Salt, diſſolved in it, may be adminiſtered. The general practice, in this caſe, is to give an emetic; but conſidering that the powers of the machine are ſtill very weak, the agitation of vomiting is certainly hazardous.

97. The patient ſhould on no account be left alone, until the ſenſes are perfectly reſtored, and he be able to aſſiſt himſelf; ſeveral perſons having relapſed and been loſt, from want of proper attention to them, after the vital functions were, to all appearance, completely eſtabliſhed.

98. Either from the diſtention which the arteries of the lungs have ſuffered (66) or from the ſudden change from great coldneſs to conſiderable warmth, it now and then happens, that the patient is attacked, ſoon after recovery, with inflammation of ſome of the parts within the cheſt. This occurrence is pointed out by

pain in the breaſt or ſide, increaſed on inſpiration, and accompanied with frequent, and full or hard pulſe, and ſometimes with cough. Here the taking away ſome blood from the arm, or the application of cupping-glaſſes, leeches, or a bliſter, over the ſeat of the pain, will be very proper; but the neceſſity for theſe meaſures, as well as the time for putting them in practice, ſhould be left to the judgment and diſcretion of a medical perſon.—Dull pain in the head, laſting ſometimes for two or three days, is by no means an unfrequent complaint in thoſe who are recovered from this and from the other ſtates of ſuſpended animation; and here alſo a moderate bleeding from the neck, either with the lancet or with cupping-glaſſes, may prove ſerviceable.

Apparent Death from Hanging, and the Means of Recovery.

99. IN hanging, the external veins of the neck are compreſſed by the cord, and the return of the blood from the head thereby impeded, from the moment that ſuſpenſion takes place; but as the heart continues to act for a few ſeconds after the wind-pipe is cloſed, (14), the blood which is ſent to the head during

this interval, is neceſſarily accumulated there. Hence it is, that in hanged perſons the face is greatly ſwoln, and of a dark red or purple colour; the eyes are commonly ſuffuſed with blood, enlarged, and prominent. On diſſection, the blood-veſſels of the brain are found conſiderably diſtended; but, in general, no farther marks of diſeaſe appear within the ſcull. —The lungs are found, generally quite collapſed, and free from frothy matter.—The heart, and the large blood-veſſels adjoining to it, exhibit the ſame appearances as in the bodies of drowned perſons.

100. From the great accumulation of blood in the veſſels of the head, many have been of opinion, that hanging kills chiefly by inducing apoplexy; but the following experiment made at Edinburgh ſeveral years ago, by an eminent medical profeſſor there, clearly proves, that in hanging, as well as in drowning, the excluſion of air from the lungs is the immediate cauſe of death. A dog was ſuſpended by the neck with a cord, an opening having been previouſly made in the wind-pipe, below the place where the cord was applied, ſo as to admit air into the lungs. In this ſtate he was allowed to hang for three-quarters of an hour, during which time the circulation and breathing went on. He was then cut down, without appear-

ing to have ſuffered much from the experiment. The cord was now ſhifted below the opening into the wind-pipe, ſo as to prevent the ingreſs of air to the lungs; and the animal being again ſuſpended, he was completely dead in a few minutes.

101. Upon the whole, then, it appears, that the ſame meaſures recommended for drowned perſons, are alſo neceſſary here; with this addition, that opening the jugular veins, or applying cupping-glaſſes to the neck, will tend conſiderably to facilitate the reſtoration of life, by leſſening the quantity of blood contained in the veſſels of the head, and thereby taking off the preſſure from the brain. Except in perſons who are very full of blood, the quantity taken away need ſeldom exceed an ordinary tea cupful, which will in general be ſufficient to unload the veſſels of the head, without weakening the powers of life.

Suffocation by Noxious Vapours.

102. NOXIOUS vapours ariſe from various ſources, as from Cyder, Perry, and malt-liquors, during their ſtate of fermentation, —from lighted charcoal,—and from brick and

lime kilns whilſt burning; they are alſo found to occupy deep vaults, ſewers, pump-wells, wells of ſhips, mines, and other places that have not a free circulation of air.

103. It would appear, that the breathing of ſome of thoſe vapours is attended with other effects, beſides that of merely excluding *vital air* from the lungs; for in perſons ſuffocated by them, the blood preſerves it's fluidity, the limbs continue flexible, and the body retains it's natural, or even a greater degree of warmth, —for many hours after death: the veſſels of the brain are generally diſtended with blood,* as in the caſe of hanging. The lungs, however, are ſound, and the heart and large blood-veſſels are in the ſame ſtate as in drowned perſons.

104. When the accident is recent, and the body retains it's heat, the application of cold water to the head, neck, breaſt, and other parts, has been found of great ſervice in pro-

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* The late Dr. Cullen, when treating upon the ſubject of apoplexy in his lectures, uſed to mention the caſe of a brewer, whoſe practice it was to hold his head over the vats of fermenting liquor, in order to diſcover how far the fermentation had proceeded, which he knew by the pungency of the *fixed air* (102) ſeparated from the liquor: he would frequently ſtay ſo long over it, as to occaſion his falling backwards from giddineſs; and to this practice the doctor attributed the apoplexy with which he was afterwards ſeized.

moting recovery.† For this purpoſe, the body ſhould be ſtripped naked, and laid in the open air, upon a door or boards placed in a ſlanting poſition, ſo that the head and ſhoulders may be conſiderably elevated. The cold water is then to be daſhed ſmartly and repeatedly upon different parts, and eſpecially upon thoſe mentioned above, until the temperature of the body be reduced to the natural ſtandard, or until ſigns of life appear.

105. If the body, however, be under the natural temperature, then it will be neceſſary to apply heat.

106. In the mean time, the lungs ſhould be diligently inflated, and the noſtrils ſtimulated, as directed under the article *Drowning*.

107. Where the veins of the neck appear very turgid, ſome blood may be taken from

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† It is probable that the firſt hint of this was taken from what appears to have been long known, and practiſed by the people who live in the neighbourhood of the *Grotto del Cani*, near Naples. The floor of this cavern is covered about a foot deep, with a natural *fixed air*, which ſuffocates any animal that is held under it but for a ſhort time. Dogs are uſually the ſubjects of this experiment, which is often made to gratify the curioſity of travellers. If the animals which have been thus deprived of ſenſe and motion, be immediately removed into the open air, they gradually recover without any aſſiſtance; but their recovery is found to be much expedited, by plunging them ſeveral times in the adjacent lake.

them, either by the lancet or by cupping glaſſes.

108. A violent pain in the ſtomach has ſometimes taken place after recovery, and been removed by giving a briſk purgative or emetic, which evacuated a great quantity of bile.

Smothering from Confinement under Bed-Clothes.

109. FROM inattention, and other cauſes, young children are frequently ſmothered in beds and cradles. When this happens without their having been bruiſed by overlaying, &c. the functions of life are ſuſpended merely from the want of *vital air*. The vital organs are found to have ſuſtained no particular injury; the lungs are collapſed, and the *right* cavity of the heart, and the large veſſels belonging to it, are diſtended with blood.

110. If the body be hotter than is natural (which is often the caſe*), it ſhould be expoſed to a current of air, and ſprinkled with cold water. The lungs ſhould be immediately inflated, and the

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* This happens from the child having breathed the *foul* air (103), which remains after the vital portion of the common air that was contained under the bed-clothes, has been all conſumed (26--27).

the body afterwards treated as in the caſe of drowned perſons.

Still-born Children.

111. WHEN a ſtill-born child appears in every reſpect perfect, and eſpecially when, from the circumſtances of the labour, there is reaſon to think that the child has not been long dead,* meaſures may be taken for recovery, with very great hopes of ſucceſs. With this view, the lungs ſhould be diligently inflated, and the heat of the body kept up by the application of warm flannels, or by putting the feet and legs, or the whole body up to the chin, into warm water. Moderate frictions with the naked hand, and gentle agitations, may alſo be uſed, and ſtimulating remedies applied to the noſe, temples, and parts oppoſite the heart.

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* Some caſes which have come within our knowledge, prove that ſtill-born children may be recovered even after an hour or more has elapſed from the time of their birth. How much later than this a recovery is practicable, future experience muſt determine; but there are ſeveral reaſons for thinking, that the vital principle is not ſo ſoon deſtroyed here, provided the warmth of the body be kept up, as when reſpiration has been eſtabliſhed for a length of time, and then interrupted.

112. If the wooden tube (Fig. 3.) be not at hand, the female Catheter, an inſtrument which every practitioner in midwifery is preſumed to carry conſtantly about with him, will anſwer tolerably well for inflating the lungs in this caſe: in defect of it, a joint of reed, or the barrel of a quill may be employed,—one end being introduced into the mouth, and the aſſiſtant blowing into the other with his breath,§ until the lungs are expanded; then gently preſſing the cheſt,—and repeating this, ſo as to imitate natural reſpiration.

113. Before children are born, and until they have begun to cry, the tongue is drawn back into the throat, ſo that a kind of valve which is attached to it's root, is ſhut down over the aperture into the wind-pipe, and the entrance of any foreign matter into the lungs thereby prevented. A finger ſhould therefore be introduced into the throat, and the root of the tongue be drawn forward and this valve raiſed, before we proceed to inflation. Perſons who

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§ This method from it's being very convenient, will, no doubt, be ofteneſt employed; but that by means of the bellows, though leſs eaſy, is certainly preferable, the air thus thrown into the lungs of the child, not being deprived of it's vivifying quality, as that is which has juſt paſſed through the lungs of a living perſon; hence we may ſucceed by uſing bellows, after we have failed in the other ways.

are not aware of this circumſtance, will be often foiled in their attempts to expand the lungs, and inſtead thereof will fill the ſtomach with air: in order ſtill more certainly to avoid doing this, the upper part of the wind-pipe ſhould be preſſed gently backwards, as already noticed in the treatment of drowned perſons.

Fainting Fits.

114. THESE appear to ariſe from the energy of the brain being ſuddenly ſuſpended,—in conſequence of which the heart immediately ceaſes to beat, and the perſon falls down deprived of ſenſe and motion.

115. When the powers of life have not been previouſly exhauſted by diſeaſe, fatigue, or want of food, a recovery generally takes place after a ſhort interval, and often without any thing being done. But ſhould this not be the caſe, the feet and legs may be immerſed in warm water, and the noſtrils ſtimulated by applying Spirit of Hartſhorn to them. If theſe fail, inflation of the lungs, and the other means already enumerated under the article *Drowning* ſhould be had recourſe to.

116. It is ſtill a very common practice to open a vein in ſuch caſes; but beſides that

ſainting generally occurs in perſons who are ill able to bear the loſs of any blood, the meaſure appears in itſelf nowiſe ſuited to promote recovery, but rather the contrary, and is now very properly going into diſuſe.

117. The faintings which moſt require aſſiſtance, and to which therefore, we wiſh particularly to direct the attention of our readers and the public, are thoſe that take place from loſs of blood, violent and long-continued fits of coughing, exceſſive vomiting or purging, great fatigue or want of food, and likewiſe after convulſions, and in the advanced ſtage of low fevers.* It is but ſeldom that any attempt at recovery is made in ſuch caſes, and ſeveral reaſons may be aſſigned for this,—particularly, the great reſemblance that fainting fits of any duration, bear to actual death, and the belief of the by-ſtanders that the circumſtances which preceded, were ſufficient

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* In no caſe do faintings happen ſo frequently and of ſuch long continuance, as in the hyſteric fits to which women are ſubject. It is ſurprizing to ſee how long ſuch perſons will lie without either pulſe or breathing, and yet recover of themſelves. In theſe faintings, however, the countenance generally preſerves it's natural colour and appearance, or becomes alternately pale and fluſhed, and the body uſually maintains it's temperature unaltered; whilſt in the other and more dangerous ones enumerated above, a death-like paleneſs and coldneſs overſpread the whole body, and continue until a recovery is brought about by means of proper remedies.

to deſtroy life entirely: to theſe may be added another, which has no ſmall ſhare in deterring medical men from undertaking any thing that is new or uncommon,—we mean, the dread of being ridiculed by their brethren or the public, ſhould they fail in an attempt which will be oftener believed to proceed from an affectation of ſingularity, and a wiſh to attract notice, than from a ſound judgment, and real knowledge in their profeſſion. To the doubts of ſome, and the obſtinate diſbelief of others, we would oppoſe the authenticated examples of ſucceſs which exiſt upon record, and which, although they do not flatter us with the hope that our attempts will ſucceed as often here as when the powers of life had not been previouſly weakened, are yet ſufficiently numerous to prove, that ſuch attempts ought to be more frequent, and that whenever they become ſo, ſociety will be benefitted by the preſervation of many valuable lives, and an important addition be thus made to the extent and uſefulneſs of the healing art.*

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* The following caſes, ſelected from among the number of ſucceſsful ones which we have read or heard of, afford the moſt ſtriking proofs that can be given, of what we have endeavoured to urge above.—

In the year 1784, at a meeting of the Phyſical Society, held at

118. In the caſe of drowning, hanging, &c. where the heart continues to act for a few times after the reſpiration is ſtopt, the *left* cavity,

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at Guy's Hoſpital, London, the following caſe was related by Dr. Hawes; a gentleman, to whoſe perſevering efforts the public may, in a great meaſure, conſider themſelves as indebted for the eſtabliſhment of the Humane Society, and the numberleſs advantages with which it has been attended throughout this kingdom.—The doctor was deſired to viſit a literary gentleman, of a middle age, who had laboured under a ſlow fever for about nine days before. Excepting debility, there was no urgent ſymptom preſent, nor did the doctor apprehend any danger. About three hours after his viſit, however, he was ſent for in a great hurry, and upon his arriving, found the gentleman without pulſe or breathing, and was told he had been in that ſtate at leaſt a quarter of an hour. The feet and ſtomach were immediately fomented with hot brandy, and about half a pint of Madeira wine poured down the throat. After ſome time a tremulous motion was obſerved in the under lip, and ſoon after the patient began to ſigh; the artery of the wriſt could now be perceived to beat, and by continuing the above means, the gentleman became quite ſenſible, and at length perfectly recovered.

At a meeting of the ſame ſociety in the winter of 1785, a medical gentleman related the following inſtructive caſe which happened in his own family.—A child who had for ſome time laboured under a cough, was ſuddenly attacked with difficulty of breathing, and to all appearance died. The gentleman immediately inflated the lungs, and by perſiſting in this for a conſiderable time, recovered the child. A ſimilar ſtate of ſuſpended animation took place *three* or *four* times, and inflation was as often had recourſe to with the ſame ſucceſs; but the attack happening unfortunately to recur whilſt the gentleman was from home, the proper meaſures were not taken, and the child expired.

The

cavity, together with the veſſels leading to and from it, are found nearly empty (66, 99, 103, &c.). Hence, ſhould it even happen here, as in moſt caſes of fainting, that the ſenſibility of the body returned ſpontaneouſly after a certain interval, or, that we could reſtore it, by means of ſomething which operated immediately upon the brain and nerves,—ſtill it would be neceſſary to inflate the lungs, and thus

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The laſt caſe we ſhall take notice of, is chiefly important, as ſhewing that it is often within the power of the ordinary attendants, to purſue with ſucceſs the means neceſſary for recovery.

Dr. Engleman, in a treatiſe upon this ſubject, relates the caſe of a woman who, after being happily delivered, fainted ſuddenly, and lay for more than a quarter of an hour apparently dead. A phyſician was immediately ſent for, but the maidſervant becoming impatient at his delay, extended herſelf upon her miſtreſs, and applying her mouth to her's, blew in as much breath as ſhe could. In a little time the exhauſted woman awaked as out of a profound ſleep, and proper things being given to her, ſhe ſoon recovered. The maid being aſked how ſhe came to think of this expedient, ſaid, that at *Altenburg* ſhe had ſeen it practiced by midwives upon children with the happieſt effect. It is impoſſible to read this caſe, and not be ſtruck with the great reſemblance which it bears to what was practiſed by Eliſha upon the child of the Shunamite as recorded in 2 Kings, chap. IV.—*And he went up, and lay upon the child, and put his mouth upon his mouth, and his eyes upon his eyes, and his hands upon his hands*; *and he ſtretched himſelf upon the child, and the fleſh of the child waxed warm, and he returned and walked in the houſe to and fro, and went up and ſtretched himſelf upon him*; *and the child ſneezed ſeven times, and the child opened his eyes.*

thus ſupply the left cavity of the heart with blood fitted to act upon it, before the circulation could be renewed, and a recovery brought about. But in fainting, the heart *immediately* ceaſes to act, ſo that the blood which had undergone the neceſſary change in the lungs, and got into the *left* cavity of the heart, and the veſſels belonging to it, remains there, and excites theſe parts to contract upon it and puſh it onwards, as ſoon as they become ſenſible to it's ſtimulus, by the influence of the brain and nerves being reſtored.—Theſe circumſtances explain to us, why perſons are more readily recovered from fainting, than from the other caſes of ſuſpended animation; and alſo, why there is ſeldom any thing more required in this caſe than to rouſe the heart to action, by means of ſtimulants.

119. The remedies that may be employed for this purpoſe, are either external, or internal. The external are, warm water, &c. (82, 3, 4), ſharp muſtard, Spirit of Hartſhorn, or of Sal Volatile, Eau de Luce, and Volatile Liniment (87). Brandy, Rum, or Gin, may alſo be uſed externally, provided that care be taken to prevent their evaporating faſt (87), and thus counteracting the good effects which their ſtimulating quality would otherwiſe produce: the parts to which theſe matters ſhould be

applied, as well as the beſt method of uſing them, have been already noticed (87). Putting the hands, feet, and legs, into warm water, or fomenting theſe and other parts with flannels wrung out of the ſame, are particularly ſerviceable in the faintings which happen in conſequence of great loſs of blood, exceſſive vomiting or purging, &c.; and the good effects of this remedy in ſuch caſes, does not depend ſo much upon the water ſtimulating by it's warmth, as from a quantity of it being abſorbed, and carried into the blood, where it ſupplies by it's bulk the fluids that were loſt, and gives to the veſſels that degree of fulneſs which they require, in order to keep up the circulation, and maintain the functions neceſſary to life.*

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* There is nothing that refreſhes and recruits a perſon who is exhauſted by fatigue, ſo ſoon as the warm bath; and the ſudden and conſiderable increaſe of weight which ſuch perſons are found to have gained by uſing it, ſhews that a great quantity of the water muſt have been abſorbed.

When the fainting proceeds from loſs of *blood*, the water abſorbed in this way will ſupply the *bulk*, but not the *qualities* of the fluid loſt; and if the quantity loſt has been conſiderable, the patient, though he recover from the fainting fit, may afterwards die from the deficiency of that ſtimulus which the red part of the blood only can afford. In ſuch caſes, and in ſuch only, would the experiment of transfuſing blood from the veſſels of a living animal into thoſe of a living perſon, promiſe to be of real uſe.

120. As internal ſtimulants, from a gill to half a pint of wine, warmed and ſome ſugar and any agreeable ſpice added to it,—three or four table ſpoonfuls of brandy or other ſpirit, diluted with two or three times the quantity of water,—or a gill of mint water, mixed with a tea ſpoonful of Spirit of Hartſhorn, Volatile Aromatic Spirit, Eau de Luce, Æther, or Hoffman's Anodyne Liquor, may be introduced into the ſtomach by the flexible tube; and when that is not at hand, and the liquid cannot be got down the throat without it, a double quantity ſhould be given by way of glyſter.

121. Where exceſſive vomiting or purging has been the cauſe of the fainting fit, the return of theſe, and of the fainting, is beſt prevented by giving, according to the age of the patient, from ten to thirty drops of Laudanum, in a glaſs of mint water, warm wine, or brandy and water,—or adminiſtering a double quantity in the form of glyſter: but unleſs in caſes of great emergency, this ſhould be left to ſome medical perſon.

Inſenſibility, and Apparent Death, from Intoxication.

122. FREQUENT dreadful examples have ſhewn, that ſtrong liquors drank in large quantity, will put an end to life almoſt inſtantaneouſly; and it would appear that they do this, by affecting the nerves of the ſtomach in ſuch a manner as entirely to deſtroy the influence of the brain. In general, however, the fatal effects of intoxication are gradual, and do not ſo much depend upon the liquor acting immediately as a poiſon, as upon it's rendering the perſon incapable of conducting himſelf, in conſequence of which he falls down, and lies in ſome poſture that obſtructs either the circulation, the reſpiration, or both.

123. Intoxicating liquors ſeem univerſally to produce an increaſed flow of blood to the the head; and an accumulation in the veſſels of that part, will occur more readily and to a greater degree, if the perſon has chanced to lie with his neck bent, or his head lower than the reſt of his body: in this way, a ſtate of apoplexy has been often induced.*

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* The apoplexy ariſing from intoxication may generally be diſtinguiſhed from others, by attending to the ſmell of the patient's

124. If the countenance be ſwoln, and of a dark red or purple hue, and theſe appearances do not go off upon keeping the body for a ſhort time in an erect poſture, it will be proper to take ſome blood from the jugular veins, or apply cupping glaſſes to the neck.

125. When the pulſe and breathing continue, and the body is hotter than natural, cloths dipt in cold water, and applied to the head, neck, ſtomach, and breaſt, have often been found ſerviceable in reſtoring intoxicated perſons to their ſenſes; and theſe applications will frequently render bleeding unneceſſary.

126. But of all the remedies that have been tried in ſuch caſes, an emetic contributes moſt ſpeedily to recovery; firſt, by emptying the ſtomach of a great part of the noxious fluid which the perſon had taken, and ſecondly, by producing a more equable diſtribution of the blood throughout the body, in conſequence of the general agitation which the action of vomiting occaſions. For this purpoſe, three or four table ſpoonfuls of Ipecacuanha Wine, —thirty or forty grains of Ipecacuanha in powder,—

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patient's breath; and the diſtinction, when it can be made, is of conſequence, as emetics, which are of very doubtful tendency in ſpontaneous apoplexy, are highly uſeful in that occaſioned by ſtrong liquors.

powder,—or a couple of grains of Emetic Tartar diſſolved in half a gill of water, may be adminiſtered, and their operation promoted when it has begun, by plenty of luke-warm water. Should the perſon be incapable of ſwallowing, the emetic may be introduced into the ſtomach by means of the flexible tube and ſyringe.

127. Where the flexible tube cannot be procured, or when the emetic fails to operate, a pint of luke-warm water, with two heaped table ſpoonfuls of common ſalt diſſolved in it, ſhould be given in glyſter; and this has been known to empty the bowels, and procure ſpeedy relief, after ſeveral other meaſures had been tried without effect.—It will be neceſſary to repeat the emetic or glyſter, if the firſt that was given has not produced the wiſhed-for operation.

128. The beſt poſition for the body to be placed in, is, lying on one ſide, with the head and ſhoulders raiſed by pillows.—After the perſon is ſo far recovered as to be ſuffered to go to ſleep, he ſhould be carefully watched, leſt his neck be anywiſe bent, or his head ſlip down under the clothes, or hang over the ſide of the bed (123). Care ſhould alſo be taken, that nothing tight be allowed to remain about the neck.

129. If the hands and feet have become cold, they ſhould be put into warm water, or wrapped in flannels well wrung out of the ſame, to be changed for others as they cool. And if neceſſary, bottles of hot water, or heated bricks, covered with flannel, may afterwards be applied to the feet, &c.

130. When the ordinary ſigns of life have diſappeared, the ſame meaſures recommended for drowned perſons, will be proper; obſerving, however, always to adminiſter a briſk emetic, or ſharp purgative glyſter, as ſoon as the pulſe and breathing are fully renewed.

Apparent Death from Blows, Falls, and the Stroke of Lightning.

131. WHEN a perſon is deprived of ſenſe and motion from any of theſe cauſes, and does not recover in the ſpace of a few ſeconds, it is commonly ſuppoſed, although no marks of violence appear on the body, that ſo great a degree of injury has been done to ſome of the vital organs, as to render a recovery impoſſible. Such haſty concluſions, however, are extremely improper, as experience has repeatedly ſhewn them to be falſe in each of the ſeveral caſes.

132. We frequently ſee perſons ſtunned by falls or blows, continue in a ſeemingly lifeleſs ſtate for ſeveral minutes, and yet recover without any particular aſſiſtance, notwithſtanding that they have ſuſtained evident and conſiderable external injury. We certainly ought not then, in ſimilar accidents, to be diſcouraged from attempting a recovery, by the mere appearance of violence externally, when this does not amount to an abſolute proof that death muſt inevitably be the conſequence of it.

133. In the inſtance of lightning indeed, little can be hoped for, if it has left any very conſiderable marks upon the body; as in this caſe, diſſection has generally ſhewn, that the brain, or ſome other organ neceſſary to life, had ſome of it's blood-veſſels burſt, or it's ſubſtance torn or otherwiſe irrecoverably deranged. But if, upon examination, no ſuch marks can be diſcovered, we ought to conclude that a recovery is poſſible, and to take meaſures accordingly.

134. In the ſuſpenſion of life by falls, blows, or lightning, as in the caſe of fainting, both cavities of the heart ceaſe to act at the ſame inſtant, ſo that the *left* cavity, and the veſſels connected with it, contain a ſufficient quantity of florid blood (16), to

renew their contractions whenever their ſenſibility is reſtored. Hence it is, that whatever reſtores the influence of the brain over the heart and the muſcles of reſpiration, is found to be the moſt effectual means for promoting recovery. Stimulants of every kind, have this tendency in a greater or leſſer degree, but none ſo much as Electricity, which, beſides being the moſt powerful means yet diſcovered for rouſing the vital principle into action, has this peculiar advantage, that it pervades the inmoſt receſſes of the animal frame, and therefore can be made to operate directly upon the parts affected.

135. This recommendation of Electricity does not depend upon mere theory, but is drawn from inſtances of it's ſucceſs in real caſes,* as well as in experiments made upon fowls and other ſmall animals, which after being completely deprived of ſenſe and motion by a ſtrong electrical ſhock paſſed through the head or cheſt, were perfectly recovered by tranſmitting ſlighter ſhocks through the ſame parts; and in this way animation has been ſuſpended and reſtored alternately for a conſiderable number of times. Beſides, perſons ſeemingly killed by lightning, have frequently been

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* See Reports of the Humane Society for 1787, 8, & 9, p. 157.

been reſtored by the ordinary means uſed in other caſes of apparent death;† and from the ſuperior ſtimulant power of Electricity, there is every reaſon to think, that it would have been ſucceſsful in many caſes where theſe alone have failed.

136. But although Electricity ranks firſt in point of efficacy here, and ſhould always be employed where it can, the other means are not therefore to be neglected. If the body has loſt any of it's natural warmth, it will be proper to reſtore it by the application of heat to the ſkin (82, 3, and 4); and for the ſame reaſon (60), as well as for others that have been already given (16 and 71), inflating the lungs will often contribute materially to a recovery.

137. The ſhocks employed, ſhould at firſt be moderate (94 and note *), and gradually increaſed in ſtrength as may be found neceſſary. The brain, ſpinal marrow, and heart, are the parts to which they ought chiefly to be applied, as being thoſe primarily affected, and the renewal of whoſe functions is abſolutely neceſſary to the reſtoration of life.—With regard to the mode of uſing this remedy, we

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† See Reports of the Humane Society for 1787, 8, & 9, pages 153, and 155.

have nothing to add to what has been ſaid in par. 94.

138. To aſſiſt the meaſures recommended above, ſome ſtimulant matter (90) may be injected into the ſtomach by means of the flexible tube and ſyringe, or thrown into the inteſtines by way of glyſter (89). Very little benefit, however, is to be expected from theſe, when Electricity, duly applied, has failed of producing any ſenſible effect.*

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* With a view to impreſs more ſtrongly upon the minds of our readers, the practicability of recovering perſons under the circumſtances of apparent death, mentioned above, we have ſubjoined the following caſes.—

A lad in perfect health, fell from a two-pair-of-ſtairs window into an area, and was taken up to all appearance dead. Upon the ſtricteſt examination, no mark of violence could be diſcovered either upon the head or any other part. After a variety of means had been tried by a ſurgeon without effect, the lad was pronounced dead, and ſent home. A gentleman, paſt whoſe houſe he was carried, happening to inquire into the circumſtances of the caſe, wiſhed to try the effect of Electricity. After four ſmall ſhocks had been given, the lad ſhewed ſome ſigns of life, and by continuing them he gradually recovered, ſo that in leſs than two hours he was able to walk about the houſe.—*Reports of the Humane Society for* 1787, 8, *&* 9, *p*. 329.

A caſe nearly reſembling the above, is related in the reports of the ſame Society, for the year 1774. A child three years old, fell from a-one-pair-of-ſtairs window, upon the pavement, and was taken up without any ſigns of life. An apothecary being ſent for, he declared that nothing could be done, and that

Of the Effects ariſing from Expoſure to intenſe Cold, and the Treatment neceſſary for Recovery.

139. IN Chap. III. we have endeavoured to explain in as ſhort and as eaſy a manner as we could, the method which nature employs to furniſh the living body with HEAT. It was there ſhewn that the *pure air* taken into the lungs imbibed a quantity of *phlogiſton*, and in return, imparted to the blood a proportionable quantity of the principle of heat. In thoſe climates and ſeaſons in which the temperature of the air is not many degrees below that of the blood, the quantity of *ſenſible* HEAT carried off from the body, would be very trifling, were it not for the copious evaporation which takes place from the ſkin (note * p. 28), and even then, the quantity of HEAT abſorbed by the blood in the lungs, and ſet at liberty in the courſe of the circulation, is ſufficient to ſupply this demand, and keep up the temperature of the

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that the child was irrecoverably dead; but a gentleman who lived oppoſite to the place, propoſing a trial with Electricity, the parents conſented. At leaſt twenty minutes elapſed before he could apply the ſhock, which he gave to various parts of the body without any appearance of ſucceſs. At length, on ſending a few ſhocks through the cheſt, a ſmall pulſation became perceptible; ſoon after the child began to ſigh, and to breathe, though with great difficulty: in about ten minutes, ſhe vomited. A kind of ſtupor remained for ſome days; but ſhe was reſtored to perfect health and ſpirits in about a week.

the body to it's natural ſtandard of 98 degrees, without any external aid: hence it is, that the natives of the very warm climates generally go with their bodies almoſt naked; the ſlight and ſcanty covering which they employ, being rather worn for the ſake of ornament and decency, than for any other reaſon. But in a climate ſuch as ours, and ſtill more in colder ones, the quantity of HEAT acquired by the blood during reſpiration, would be far from ſufficient for the purpoſes of life, if no auxiliary means were uſed. Beſide the aſſiſtance, therefore, which is occaſionally given by means of fires, it is found neceſſary in ſuch climates, particularly during the winter-ſeaſon, to wear what is commonly termed *warm clothing*. It is not, however, from poſſeſſing any warmth in itſelf that this ſort of covering proves uſeful, but merely from the wool or other matter of which it is compoſed, being a very ſlow conductor of *ſenſible* HEAT, and thereby preventing the HEAT from being carried off by the air and ſurrounding bodies, faſter than it can be ſupplied by the proceſs already deſcribed,—and, conſequently, preventing the warmth of the body from being reduced below the degree which is neceſſary to the due performance of the functions of life.

140. The general mildneſs of the climate, the influence of faſhion, and the inconvenience of very warm cloathing in many avocations of civilized life, are the principal reaſons why the dreſs worn by the inhabitants of this country, is ill ſuited to protect them from the effects of ſevere cold. Thus circumſtanced as to clothing, we may reckon it fortunate, that in the great and ſudden variations of temperature for which this climate is remarkable, the cold is ſeldom ſo intenſe as completely to deſtroy life by a ſhort expoſure to it, and that the opportunities of ſhelter and aſſiſtance are ſo numerous, as to render death from this cauſe, rather an unfrequent occurrence.

141. In many of the more northern countries, the cold is ſo intenſe during the winter ſeaſon, as frequently to ſtop the circulation, and deſtroy the life, in ſuch parts of the body as are moſt expoſed to it, and this ſo quickly, that the ſufferer is ſometimes not aware of what has happened, until too late to do any thing for their preſervation.† The fingers, toes, noſe,

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† A gentleman told me, that once when walking through the ſtreets of Quebec during the winter ſeaſon, he was ſuddenly accoſted by a perſon belonging to the place, who happened to be paſſing, and who, to his great ſurprize, informed him that his noſe was *froſt-bitten*; which the perſon immediately knew by the

and ears, are the parts which ofteneſt ſuffer from being thus *froſt-bitten*, as it is termed. Mortification of the parts affected, is the uſual conſequence in thoſe caſes when proper means are not employed early; and nothing is found to contribute ſo much to this diſagreeable event, as the ſudden application of heat: even in this country, it is a matter of common experience, that when the hands or feet are numbed by cold, holding them to the fire, or waſhing them in warm water, is productive of much pain at the time, and not unfrequently of troubleſome inflammation, ſometimes ending in ſores that are very difficult to heal. To avoid all theſe diſagreeable conſequences, the loſt warmth ſhould be reſtored in the moſt gradual manner, beginning firſt by rubbing the numbed parts well with ſnow, or waſhing them for ſome time in very cold water, and afterwards,

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the peculiar livid appearance which the part aſſumes in that caſe, although the gentleman himſelf was not apprized of the circumſtance by any uneaſy ſenſation. Putting up his hand, however, he was convinced that what the perſon ſaid was true, for the part was quite cold, and had entirely loſt it's feeling; but by rubbing it well with ſnow, the natural warmth and ſenſibility were reſtored, and he eſcaped without any other inconvenience than the loſs of the ſkin, which inflamed, and after a few days came off.——Had the friction with the ſnow been delayed but a few minutes longer, there can be no doubt but the gentleman would have loſt his noſe entirely.

if neceſſary, ſlowly raiſing the temperature of the water employed, by adding to it from time to time, ſmall quantities of warm water, and continuing the waſhing, until the parts affected have regained their natural degree of heat.

142. Where the circulation and breathing are ſuſpended from expoſure to cold, the ſame precautions are neceſſary; for the ſudden reſtoration of warmth to the body in this caſe, occaſions ſuch a general diſturbance in the vital functions when they are renewed, as to prove almoſt inſtantly fatal. Inſtead, then, of carrying the body to the fire, or even into a warm room, it ſhould at firſt be removed to an apartment without any fire. The clothes ſhould be immediately taken off, and the whole body be well rubbed with ſnow, or waſhed in very cold water.* When this has been continued for ten or fifteen minutes, we may begin to increaſe the temperature of the body ſlowly, by uſing water made gradually warmer than the firſt, by repeated ſmall additions of hot water to it.

143. In the mean time, the lungs ſhould

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* Where the place affords the conveniency of a bathing tub, the body may at firſt be immerſed up to the neck in cold water, the temperature of which can be afterwards as gradually and ſlowly raiſed as we pleaſe, by adding warm water to it.

be diligently inflated in one or other of the methods already deſcribed (77 to 82).

144. As ſoon as the circulation and breathing are reſtored, the ſufferer ſhould be laid between the blankets in bed, in a well-aired, but not a warm room; and particular care taken, not to give him any ſtrong or hot liquors, as theſe will readily excite a feveriſh ſtate, accompanied, perhaps, with inflammation of ſome internal part which may prove fatal. Weak wine-whey, with the cold juſt taken off, will in general be a very proper drink, as it will tend to bring on a gentle perſpiration, and thereby ſerve to prevent the danger juſt mentioned.

145. If the perſon, previous to his expoſure to the cold, has been exhauſted from want of food, a ſmall piece of bread, ſopped in the yolk of an egg beaten up with a little milk and ſugar, and a tea ſpoonful or two of brandy, or half a glaſs of wine, added to it,—ſhould be given, and occaſionally repeated until the patient's ſtrength is ſo far recruited, as to admit of the cravings of appetite being gratified with ſafety.

146. But if (as often happens) intoxication has had a conſiderable ſhare in the buſineſs, an emetic, or a purgative glyſter, given as ſoon

as the pulſe and breathing are re-eſtabliſhed, will often aſſiſt in reſtoring the ſenſes, and obviating any danger (122—127, and 143) which might otherwiſe ariſe from the liquor drank: the propriety of this meaſure, however, will depend ſo much upon the circumſtances of the caſe, that we could wiſh it to be always referred where it can, to the judgment of a medical perſon.

EXPLANATION of the PLATE.

THE inſtruments repreſented in this plate, are what appeared to me beſt calculated to anſwer the purpoſe of Reſuſcitation. They were made under my immediate direction by a very good workman (Mr. Dickinſon, Surgeon's Inſtrument Maker, Cloiſters, Weſt-Smithfield); but I am ſorry to ſay that the engraving, which I was obliged to commiſſion another to get done for me, by no means does juſtice to the originals.

Fig. 1. The ſilver Canula to be introduced into the wind-pipe (par. 80), for the more effectual conveyance of air into the lungs.—The Canula is round until within two inches of the end A, when it becomes flat, and continues ſo to the point, in order to adapt it to the oblong opening of the wind-pipe: this flatneſs, however, is not well repreſented in the engraving.—To prevent any injury being done to the ſides of the aperture which forms the voice, the point of the Canula is cloſed and rounded off, and openings are made in the ſides, to allow the air to paſs into and out of the lungs.

Fig. 2. A flexible tube, furniſhed at one end with a braſs ſocket C, to fit on the end B, of the Canula; and at the other with a piece of leather ſhaped like a funnel, which can be tied round the nozzle of a common pair of bellows, with a piece of pack-thread, and the caſe be thus rendered more portable, by leaving out the bellows uſually included in it.

Fig. 3. A wooden tube, for inflating the lungs by blowing into the noſtril;—the end A, being introduced into the noſtril, and the other end receiving the nozzle of a pair of common bellows. (See par. 77, p. 44).—To make the nozzle of the bellows fit the cloſer, the wide end may be lined with a piece of ſoft chamois leather.

Fig. 4. A braſs ſyringe, which anſwers the purpoſe either of throwing fluids into the ſtomach by means of the flexible tube, fig. 5, or into the inteſtines by means of the flexible tube and pipe, fig. 6. The ſyringe holds a gill of liquid, but is here repreſented on a ſcale one-third leſs than the original, in order to bring it within the compaſs of the plate. Had it been made to hold more, it would have been very ſtiff and difficult to work, and as the pipe A, is not made to ſcrew, but to plug into the braſs ſockets of the tubes, fig. 5 and 6, it is an eaſy matter to ſlip it out, fill the ſyringe, and repeat the injection until a ſufficient quantity has been thrown in.—It was thought that this inſtrument, while it anſwered the double purpoſe mentioned above, was alſo leſs liable to be unfit for uſe when wanted, than a common pipe and bag, or a bottle formed of elaſtic gum, which latter is very apt to be ſpoilt by filling it with warm liquids.

Fig. 5. A flexible tube (made of ſpiral wire neatly covered with leather), for introducing liquids of any kind into the ſtomach. The end A, which is to be paſſed down

the gullet in the manner directed par. 79, terminates in a ſmooth knob of ivory. B. Is the ivory ſliding-piece which ſerves to plug up the paſſage into the gullet, and prevent the air from getting into the ſtomach when the lungs are inflated by means of the Canula. (See par. 79).—C. A braſs ſocket to receive the pipe A of the ſyringe, fig. 4.—The tube is here repreſented at leaſt one-third longer than is neceſſary, the original having been made of this length for the ſake of trying whether, in caſes where the power of ſwallowing is loſt from exceſſive intoxication, or from ſwallowing Laudanum, the noxious matter remaining in the ſtomach, could not be diluted, and then drawn out by means of the braſs ſyringe: the ſmallneſs of the tube, however, rendering it liable to be choaked up, the experiment did not prove ſatisfactory.—It is proper to obſerve, that the Engraver has repreſented the ſhoulder of the ſliding piece as terminating in a ſharp edge, whereas in the original, it is rounded off, to prevent any injury being done to the throat when it is withdrawn.

Fig. 6. A flexible tube, for injecting fluids into the inteſtines by way of glyſter. A. A braſs ſocket which fits on the pipe of the ſyringe. B. An ivory pipe to be introduced into the fundament.

Fig. 7. After the foregoing inſtruments had been engraven, it occurred to me that when the Canula was uſed, the air expelled from the lungs by preſſing on the breaſt, muſt either paſs by the ſides of the Canula, and ſo out at the mouth or noſtril (unſtopped for that purpoſe),—or muſt be drawn back into the bellows, and let out from thence by raiſing the valve with the finger. To avoid this, the braſs mouth-piece fig. 7, was added, to be uſed inſtead of the flexible tube fig. 2. The end A, fits on

the end B, of the Canula, (ſee par. 81, p. 47); and the wide end, which receives the nozzle of the bellows, is lined with a piece of chamois leather, to prevent the air from getting back that way when the handles of the bellows are preſſed together.

AS the Preſervative Society were already provided with eleven ſets of Mr. Savigny's Apparatus, and as it was thought a poſſible caſe, that the accident might happen at a place which could not ſupply a common pair of bellows, the bellows belonging to each ſet have been kept, and the reſt of the apparatus exchanged. Each caſe, then, as at preſent fitted up, contains the following articles.—

1. A pair of bellows.

2. A flexible tube, about nine or ten inches long, having at each end a braſs ſocket with a female ſcrew in it. Into one of theſe the nozzle of the bellows is to be ſcrewed; and into the other a perforated ivory plug to fit the noſtril, when the lungs are to be inflated in the ordinary way.

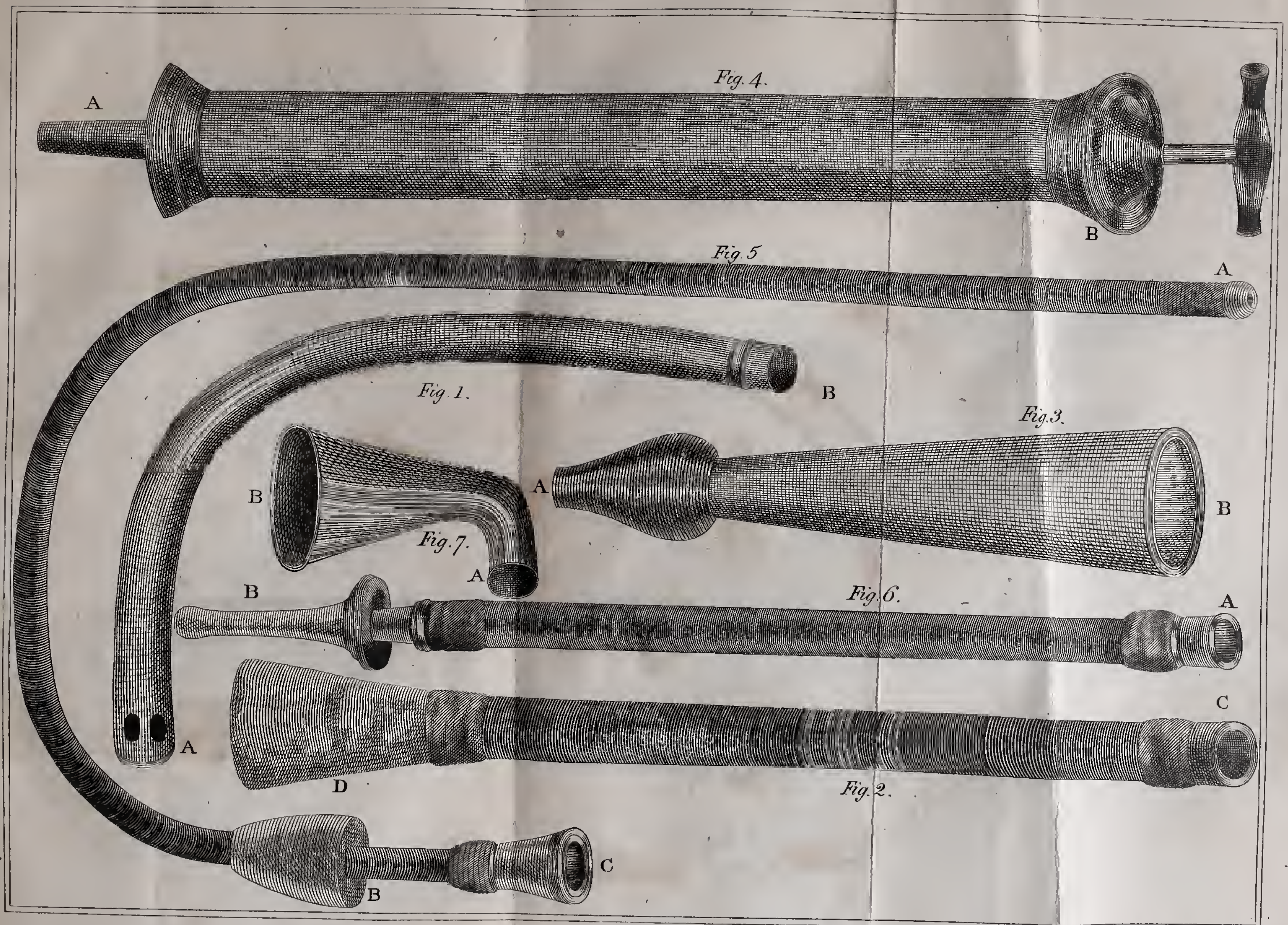
3. A ſilver Canula, made to ſcrew into the flexible tube inſtead of the ivory piece juſt mentioned, when the ordinary mode of inflation does not ſucceed. The Canula is ſhaped like that repreſented in the plate, but is made longer, ſo that when the point is in the wind-pipe, the other end B, may project far enough beyond the lips, to be held firmly between the middle finger and thumb of the right hand, by the aſſiſtant whoſe buſineſs it is to cloſe the noſtrils and mouth, and ſuſtain the Canula in it's ſituation. To allow the air thrown into the lungs through the Canula, to paſs out again without the inconvenience of unſtopping the mouth or noſtrils, or being obliged to raiſe the valve of the bellows every time as mentioned in deſcribing

fig. 7,—an opening is cut in the ſide of the Canula near to the end B. When the lungs are about to be inflated, this opening muſt be ſhut, by the aſſiſtant who keeps the Canula ſteady, preſſing the end of his fore finger againſt it: To empty the lungs, he muſt uncover this opening whilſt another makes a gentle preſſure upon the breaſt.

4. A flexible tube (like fig. 5, of the plate) for pouring liquids down the throat, and furniſhed with a ſliding piece to prevent air from getting into the ſtomach, when that is neceſſary. Inſtead of uſing the ſyringe, however, the liquor is to be gently poured into a funnel made of box-wood, which ſcrews into the braſs ſocket of the tube: if the liquor does not paſs readily, apply the mouth over the funnel and blow gently upon the ſurface of the liquor, which will force it to deſcend.

5. Two pipes, of different ſizes, fitted up with proper bladders, &c. for adminiſtering glyſters.

6. Three wooden tubes like that repreſented in fig. 3 of the plate.—It ſometimes happens that two or more perſons are drowned or ſuffocated at the ſame time; in which caſe, while the apparatus is employed in reſtoring one perſon, another may be loſt for want of having the lungs inflated, if there were only one tube for the purpoſe.



J. Paſs del. et Sculp.

APPENDIX.

Of the Treatment neceſſary in Caſes of Poiſon.

THE object of the Preſervative Society, is not confined to the diffuſing information, and offering rewards, for the recovery of perſons *apparently dead,* but extends to the preſervation of human life from various caſes of imminent danger, and among others from that by poiſon. We have, therefore, ſubjoined a few general directions upon this head, which are eaſily put in practice, and if attended to, may be the means of ſaving many, who would otherwiſe fall victims to their unfortunate miſtake† or raſh deſign.

Arſenic, Corroſive Sublimate, and Opium, are the three articles whoſe poiſonous effects will moſt frequently call for aſſiſtance.—Of theſe the Arſenic is by far the moſt dangerous, as well from it's ſudden and violent operation in corroding the coats of the ſtomach, as from the difficulty of decompoſing it,* ſo as to deſtroy

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† White Arſenic has been frequently ſwallowed through miſtake, for Nitre, or Cream of Tartar, and Yellow Arſenic for powdered Brimſtone, or Flowers of Sulphur.

* A ſolution of Liver of Sulphur has been recommended for this purpoſe, and where it can it ſhould certainly be tried,

deſtroy the activity of what has not been thrown up by vomiting. Reaſon tells us that when a perſon has ſwallowed any thing poiſonous, the moſt ſpeedy way to get rid of it, is, by exciting vomiting, and thus diſcharging it from the ſtomach. Arſenic, indeed, of itſelf occaſions vomiting, and that too of the moſt violent kind; but if vomiting be not excited before it is done by this poiſonous mineral, the ſtomach will by that time be ſo much inflamed and corroded, as to render a recovery exceedingly doubtful. As ſoon, therefore, as a perſon is known to have ſwallowed Arſenic, if vomiting has not already come on, he ſhould take thirty or forty grains of Ipecacuanha in powder, five or ſix table ſpoonfuls of Ipecacuanha Wine, or thirty grains of White Vitriol† diſſolved in a little water, and alſo endeavour to excite vomiting by tickling the throat with a feather. In the meantime, he ſhould drink plentifully of fat broth, or warm milk or water mixed with ſallad oil, freſh butter, or lard, and repeat this as long as any ſickneſs or retching continues; nor is it ſafe to abſtain from drinking as long as there is reaſon to think that any of the Arſenic remains behind. Violent pains in the bowels, ſucceeding the vomiting, give room to ſuſpect that ſome of the Arſenic has paſſed that way; in which caſe, a glyſter compoſed of a pint or more of warm water, with two ounces of Epſom or Glauber's Salt diſſolved in it, ſhould be adminiſtered without delay, and followed by repeated glyſters of fat broth, or milk with oil, butter, or lard added to it.

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† White Vitriol, though not *commonly* employed as an emetic, is perfectly ſafe, and at the ſame time that it's operation is attended with leſs ſickneſs than the other emetics, it has this advantange over them all, that it excites vomiting almoſt as ſoon as it has got into the ſtomach,—a property which renders it particularly uſeful in caſes of poiſon.

When Corroſive Sublimate has been ſwallowed, the ſame means ſhould be uſed as ſoon as poſſible, to evacuate it; but at the ſame time, half a tea ſpoonful of pearl aſhes diſſolved in half a pint of warm water, ſhould be given and repeated frequently, in order to render inert any portion of the poiſon which is not thrown up: where Pearl Aſhes are wanting, luke-warm water poured upon ſome Pot-aſhes and then ſtrained off, may be uſed in the ſame way; and in defect of theſe, ſoap diſſolved in milk or water, ſhould be employed.—By theſe means, if uſed early, we ſhall ſeldom fail of preventing the fatal conſequences which might otherwiſe have enſued from this poiſon.

In the caſe of Opium or Laudanum being taken in conſiderable quantity, vomiting ſhould, if poſſible, be excited, by giving a briſk emetic; and if the power of ſwallowing be loſt, the emetic ſhould be thrown into the ſtomach by means of the flexible tube and funnel. But in the latter caſe, inſtead of uſing the White Vitriol, we would recommend a table ſpoonful of Antimonial Wine, four or five of Ipecacuanha Wine, two or three grains of Emetic Tartar diſſolved in half a gill of water, or thirty or forty grains of Ipecacuanha in powder, to be employed; becauſe theſe, though they ſhould fail to produce vomiting, will ſerve to counteract the ſtupifying and noxious effect of the Opium, by making it operate by ſweating,*—to promote which, the feet and legs ſhould be bathed in hot water, or wrapped in flannels well wrung out of the ſame. If the flexible tube be not at hand, and the remedies mentioned above cannot be got down the throat without it, a double quantity of one or other of them ſhould be thrown into the inteſtines by way of glyſter.†—It is commonly recommended in ſuch caſes, to endeavour to rouſe the perſon and prevent him from ſleeping, by ſhaking and moving him about, and by applying bliſtering plaſters, or poultices with flour of muſtard, to his ſkin; but unleſs the poiſon be evacuated or counteracted by ſome of the remedies mentioned above, theſe will be of little uſe, and when that has been done, they will ſcarcely be neceſſary.

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* It is well known to medical men, that when either Emetic Tartar, Antimonial Wine, Ipecacuanha Wine, or Ipecacuanha in powder, is given joined with Opium, each counteracts the effect which the other would have had if adminiſtered alone,—the Opium generally preventing the Emetic Tartar, &c. from exciting vomiting, and the latter, in their turn, entirely ſuſpending the ſtupifying power of the Opium; the conſequence generally is, that they operate upon the ſkin and occaſion a very copious ſweating.

Spaniſh Flies, if taken even in but ſmall quantity, will readily bring on an inflammation of the ſtomach or bowels that may end in death. As we are not acquainted with any thing that, when taken into the ſtomach, can deprive theſe of their acrid quality, our attention ſhould be directed to evacuate them as ſpeedily as poſſible by vomiting, and afterwards make the perſon ſwallow a quantity of thick milk pottage, or ſomething of the ſame kind, which will ſerve to envelope any of the flies that may ſtill remain, and thereby protect the ſtomach and bowels from their acrimony.

Cautions,

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† When obliged to be adminiſtered in glyſter, however, the effect mentioned above will not be ſo certain or conſiderable as when they can be got into the ſtomach; but even in this way there is a chance of ſucceſs, eſpecially if we employ Ipecacuanha Wine, which is preferable to the preparations of Antimony, from it's being leſs apt to occaſion purging.

Cautions, Hints, &c.

AGREEABLY to the deſign of communicating *popular* inſtruction upon the different objects embraced by the Preſervative Society, the following cautions, &c. are inſerted here, in hopes that they will be read and attended to, by perſons who might otherwiſe have continued uninformed with regard to the dangers which they are calculated to guard againſt.

When perſons happen to be overtaken by a thunder-ſtorm, although they may not be terrified by the lightning, yet they naturally wiſh for ſhelter from the rain which uſually attends it, and, therefore, if no houſe be at hand, generally take refuge under the neareſt tree they can find. But in doing this, they unknowingly expoſe themſelves to a double danger; firſt, becauſe their clothes being thus kept dry, their bodies are rendered more liable to injury,—the lightning often paſſing harmleſs over a body whoſe ſurface is wet; and ſecondly, becauſe a tree, or any elevated object, inſtead of warding off, ſerves to attract and conduct the lightning, which, in it's paſſage to the ground, frequently rends the trunk or branches, and kills any perſon or animal who happens to be cloſe to it at the time.† Inſtead of ſeeking protection, then, by retiring under the ſhelter of a tree, hay-rick, pillar, wall or hedge, the perſon ſhould either purſue his way to the neareſt houſe, or get to a part of the road or field which has no high object that can draw the lightning towards it, and remain there until the ſtorm has ſubſided.—It is particularly dangerous to ſtand near leaden ſpouts, iron gates, or palliſadoes, at ſuch times; metals of all kinds having ſo ſtrong an attraction for lightning, as frequently to draw it out of the courſe which it would otherwiſe have taken.

We have already obſerved (par. 102), that old wells, vaults, and ſewers, which have been long ſhut up from the air, are generally occupied by vapours which ſoon prove fatal to perſons breathing them. The property which theſe vapours have, of extinguiſhing flame (par. 22 and 27), affords the means of detecting their preſence, and thereby avoiding the danger which might enſue from an incautious expoſure to them. When ſuch places, therefore, are opened to be cleaned out or repaired, a lighted candle ſhould be let down ſlowly by means of a cord, before any perſon is ſuffered to deſcend; and if it be found to burn freely until it gets to the ſurface of the water or other matter covering the bottom, the workmen may then venture down with ſafety. But if, without any accident, the candle becomes extinguiſhed in it's deſcent, and continues to be ſo in repeated trials, we may be aſſured that the air of the place is highly noxious. In that caſe, if the well, &c. cannot be left open to the air for a ſufficient length of time to purify it, ſome means ſhould be employed to expel the noxious vapour. As we do not know that the following has ever been tried, and therefore cannot venture to aſſert that it will completely anſwer the purpoſe, we propoſe it merely as a matter of experiment. Wrap up half an ounce or more, of gun-powder, very firmly, in ſeveral folds of ſtout paper, and tie it ſtrongly with a cord. Make a ſmall hole through the paper, and into that inſert a proper match,† ſo as to communicate with the powder. Make faſt the packet thus prepared, to a cord of ſufficient length, and having lighted the match, lower it down gradually until within a few inches of the water, and ſuſpend it there. As ſoon as the match has burnt out, the powder will explode, and drive out a quantity of the noxious vapour which occupied the ſpace above it.—By repeating this, the air of the place will probably be, in a ſhort time, rendered ſufficiently pure to ſupport life and flame.

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† A melancholy example of this, happened in the Earl of Aylesford's park, at Packington, near Birmingham, in the month of September, 1789. Thomas Cawſey, of London, a Farrier, who was travelling to Birmingham, being caught in a violent thunder-ſtorm, took ſhelter under a large tree in the park. The lightning ſoon after ſtruck the tree, and in it's paſſage along it to the ground, killed this unfortunate perſon. Lord Aylesford has ſince erected a monument on the ſpot, with an inſcription warning others of the great danger to which they expoſe themſelves, by taking ſhelter under trees during a thunder-ſtorm.

Perſons whoſe buſineſs requires them to attend upon large quantities of fermenting liquors, or to work in cloſe places with lighted charcoal, frequently experience head-ach, giddineſs, and other diſagreeable effects from the noxious vapours which theſe matters give out, and often have their health impaired, or their lives endangered by a continuance of the employment. In ſome caſes, the danger, perhaps,

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† The match may be made by moiſtening a piece of ſoft paper, or pack-thread, in a ſtrong ſolution of Nitre, afterwards rubbing it's ſurface over with bruiſed gunpowder, and drying it. The Nitre when ſet on fire ſupplies a quantity of pure air, which keeps the match burning in it's paſſage through the noxious vapour.

cannot be avoided,‡ except by going into the open air as ſoon as head-ach or giddineſs begins, and drinking a glaſs of cold water, or waſhing the face and neck with the ſame. Thus it is probable, that ſuch a degree of ventilation as would carry off the fixed air produced by fermenting liquors, would greatly impede, if not completely ſtop the progreſs of the fermentation, and ſpoil the liquor; but in the caſe of perſons whoſe work requires charcoal fires, particularly wool-combers, we can ſee no good reaſon for placing the lighted charcoal in a pan or round grate, in the middle of the floor (as we are told is the cuſtom), inſtead of ſetting it under the chimney, the draft of which would ſerve to carry off the noxious vapours, and keep the apartment more wholeſome. We hope that this hint will be attended to, by thoſe perſons who may have it in their power to correct the practice which gave riſe to it.

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‡ From thoſe caſes, however, we would except the cleaning out the great veſſels uſed by the porter-brewers in London, in performing which it has more than once happened, that three or four people have loſt their lives at the ſame time. Would it not be very practicable to clear theſe veſſels completely of the fixed air which remains after the liquor is drawn off, by laying on a proper air tube or hoſe, one end communicating with an opening near the bottom of the veſſel, and the other with Mr. White's ventilator, to which motion might eaſily be given either by wind or ſteam? The matter ſurely deſerves the attention of men to whom, when we conſider their wealth, the expence of it's trial can be no object.

The ſhocking accidents which daily happen to the ſervants of farmers and others, from their riding upon the ſhafts of carts and waggons, call loudly for ſome means of rendering their occurrence leſs frequent. The evils to which this hardworking and uſeful ſet of men are expoſed from their ſituation in life, are already too numerous not to render important every thing which can contribute to their diminution; nor would the time of thoſe whoſe ingenuity is ſucceſsfully exerted in multiplying the enjoyments of the rich, be leſs uſefully employed, were they to beſtow a ſhare of their talents, in deviſing means to avert ſome of the evils incident to perſons whoſe labour is ſo beneficial to the community. Little verſed in mechanical contrivances, we cannot be expected to offer more than crude hints, which may ſerve to call the attention of perſons who are competent to the taſk. The object in this inſtance is, to contrive ſome effectual means of preventing the practice mentioned above. Iron ſpikes fixed on the flat part of the ſhafts where theſe perſons ſeat themſelves, would, no doubt, be a very effectual, but not, perhaps, a very ſafe remedy. Whether the following expedient will anſwer the purpoſe ſufficiently, may be ſoon determined by the trial; it has at leaſt the recommendation of being ſafe, eaſy to execute, and of ſmall expence.—Let a piece of aſh, oak, or other ſtout wood, from eighteen inches to two feet in length, be planed up to three equal ſides, each about two and a half, or three inches broad. When one of theſe ſides is nailed along the upper and flat part of the ſhafts, where the driver is wont to ſit, the piece of wood will then preſent a ſharp ridge, upon which it will be ſcarcely poſſible for a perſon to reſt himſelf, though but for a few ſeconds.—To prevent this ridge from being cut or broken down, two pieces of iron hoop ſhould be nailed along each ſide, ſo that their edges may join at top; or the piece may be croſſed by ſeveral ſtraps of iron, which, while they in ſome meaſure anſwer the ſame purpoſe, will alſo ſerve to keep the wood faſt upon the ſhaft.

It has been found that the bodies of perſons drowned in ſmall rivers or ponds, are much ſooner diſcovered and taken out by means of common rakes, or of hooks fixed on long poles, than by the drags, which are beſt calculated for thoſe places where the water is deep and broad, and where boats can be had to make uſe of them. As the gaining even of a few a few minutes in ſuch caſes, is often of the utmoſt importance, it is recommended to the inhabitants of thoſe places which have rivers or ponds in their neighbourhood, to be provided with ſeveral inſtruments of the form and and ſize of a *muck-drag*, but with the tines or prongs rather more bent down. Theſe inſtruments are to be fitted on light poles of ten or twelve feet in length: and to prevent the body receiving any injury from them, each tine or prong ſhould be guarded by a ſmall plate of iron, ſhaped like the ſegment of a circle, and welded on about half an inch from the point, in the ſame way that is now done with the drags.—On an emergency, an inſtrument like what we have deſcribed, may be eaſily made; by heating the prongs of a common pitching fork, then bending them down at the place where they divide, to about a right angle with the ſhaft, and guarding the points by welding a ſmall piece of iron acroſs each prong, about half an inch from the extremity.

It will ſometimes happen, that the body cannot be reached by theſe inſtruments, and no boat be at hand to uſe the drags in the ordinary way. In ſuch caſe we would recommend, that the drag be made faſt to the middle of a long rope, which is to be ſtretched acroſs the river or pond, and by means of it, the drag pulled from bank to bank, in a zig-zag direction, ſo as to leave no part of the water unſearched.

Where deep ponds or rivers that are frozen over in the winter, are much reſorted to for the purpoſe of ſkating, &c. long ropes, fir planks, and ſeveral poles furniſhed in the manner deſcribed above, ſhould be lodged in ſome houſe near the place, ſo that they may be ſpeedily got at when wanted.—When the ice gives way under a perſon, even though he do not ſink beneath it, it is ſcarcely poſſible that he ſhould get out unaſſiſted, unleſs the water happens to be very ſhallow. A plank ſhould therefore be placed cloſe to the edge of the opening in the ice, and upon this one or two perſons may generally ſtand pretty ſecurely to help the other out. But if the ice be ſo weak as to render this method hazardous, a plank or pole ought to be ſhoved to the perſon to ſupport himſelf upon. In the mean time the end of a long rope ſhould be carried round the the place, by a light boy on ſkates, ſo that the perſon may become encloſed in it's bight or doubling, and by ſhifting it under his arms or between his legs, give a ſecure hold whereby he can be drawn out.

When the perſon has unfortunately got away from the place where he fell in, and it becomes neceſſary to ſearch after him with the hook mentioned above, or to break the ice in order to recover the body, ſeveral long planks, or a large door, ſhould be laid down, for thoſe to ſtand upon who are employed in this; for even thin ice will ſupport a very conſiderable weight, provided it be made to bear upon a large ſurface. A gentleman who had ſufficient preſence of mind to recollect this circumſtance, and courage enough to make the beſt uſe of it, was thereby the means of ſaving his companion, under whom the ice had given way whilſt he was ſkating in Hyde Park. There being no ropes or planks immediately at hand, the perſon who had fallen in, could not have ſupported himſelf until they were brought, had not the other aſſiſted him in the following manner. Having ventured as cloſe to the opening as he dared to go on his ſkates, he lay down upon the ice, and then gradually ſhoved himſelf near enough to reach out his hand to his friend, who was thus kept from ſinking until proper aſſiſtance came.

As this pamphlet may fall into the hands of medical gentlemen, who have not had an opportunity of peruſing Mr. Coleman's ingenious treatiſe on *Suſpended Reſpiration*, we have thought it right to inſert here, an account of a new method of performing the operation of Bronchotomy, propoſed by that gentleman to be employed in preference to the old one, in thoſe caſes of apparent death, where it may be neceſſary.

" The application of theſe inſtruments (viz. " thoſe for inflating the lungs) cannot be ſup- " poſed to embarraſs any profeſſional man; if, " however, any impediment ſhould prevent the " inſertion of the pipe into the air-tube, " bronchotomy ſhould be immediately per- " formed;† but the place and manner of per- " forming this operation, agreeable to the " method generally recommended, do not ap- " pear the moſt eligible.

" We are adviſed by authors, to begin it by " a longitudinal inciſion immediately below " the cricoid cartilage, and when the trachea " is met with, to divide it between the rings.

" The performance of this operation, ac- " cording to this plan, can ſcarce be attended " with danger, when attempted by a ſkilful " anatomiſt; but it may be embarraſſing to a " medical aſſiſtant, who is obliged haſtily to

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† See note * page 48.

“ perform it when, perhaps, he may not per-
“ fectly recollect the ſituation of the veſſels;
“ and it is to be remembered, that haſte is al-
“ ways particularly neceſſary upon theſe oc-
“ caſions. Allowing, however, that the
“ operation is ably performed, great incon-
“ venience muſt follow from the ſituation of
“ the wound; for in the recovery of the
“ drowned, hanged, and ſuffocated, the head
“ is, and always ought to be, kept a little
“ elevated, the conſequence of which muſt be,
“ that the aperture in the trachea then becoming
“ the moſt depending part, the flow of blood
“ that follows the operation, will principally
“ enter it, and thus prevent artificial reſpiration
“ from being properly carried on. This is not
“ a theory founded upon hypotheſis, but on
“ facts; as we have ſeen two caſes wherein
“ this accident actually happened.

“ Another inconvenience attendant on this
“ mode of operating is, that from the trachea
“ at this part being covered with ſo much in-
“ teguments, the pipe for inflating the lungs
“ cannot be properly received; and ſhould a
“ recovery be effected, the patient muſt be
“ under the neceſſity of keeping his chin
“ directed conſtantly downward, in order to
“ approximate the cartilages, a poſition that is
“ not only very diſagreeable, but to be con-
“ tinued almoſt impracticable.

" In order, therefore, to render the operation " more ſimple, leſs dangerous, and to prevent " the blood from entering the air-tube; I conceive it more eligible to divide the thyroid " cartilage: and that inſtead of the inciſion " firſt being longitudinal, and then tranſverſe, " both the integuments ſhould be cut through " longitudinally at once.

" Several are the advantages derived from " this mode of operating. Firſt, no danger " can then ariſe from want of anatomical " knowledge. Secondly, the covering being " here very ſuperficial, little blood will be loſt, " and the little that does eſcape, cannot get " into the wind-pipe. Thirdly, the curved " pipe can be very well ſecured, in order to " carry on inflation and collapſe. Fourthly, " if our attempts to recover be ſucceſsful, keeping the head naturally erect, will be the beſt " poſition to approximate the divided cartilage; " and laſtly, that the recurrent nerves are in " no danger of being divided. The only inconvenience to be dreaded from this manner " of operating, is that of committing an injury on the ſacculi laryngis, and thus to incommode the voice; but theſe are ſecured " from danger by cutting through the middle " of the cartilage; and an union will be as " completely effected, as if the trachea itſelf " had alone been divided.

“ The ſurgeon ſtanding on the right ſide of “ the patient, ſhould perform the operation “ by putting the integuments on the ſtretch “ with the thumb and fore finger of the left “ hand, a longitudinal inciſion is then to be “ made immediately over the thyroid car- “ tilage, into which may be inſerted the curved “ pipe that was intended to be introduced into “ the trachea by the mouth.”

☞ Upon reconſidering par. 133, I am inclined to think that I have gone too far, in ſaying, that conſiderable marks appearing upon the body, may be held as certain proofs of abſolute death. For beſides that it ſuppoſes (what may not be the caſe with any perſon), a power in the examiner to diſtinguiſh marks and diſcolourations of the ſkin produced by blows and other accidents, from ſimilar ones occaſioned by the lightning,—there are many examples of perſons being ſcorched and otherwiſe marked by lightning, without being even rendered inſenſible; and this being the caſe, we can eaſily conceive that ſimilar external injuries may be inflicted, where the ſhock has been ſuch as to ſuſpend, but not entirely deſtroy, the power of life, and where, of courſe, it may ſtill be poſſible to bring about a recovery.

THE END.

CORRECTIONS.

Page viii, *line* 3 *from the bottom*, *after*—heard, *add*—even
4, *line* 9, *inſtead of*—no one, *read*—none.
7, *line* 1 *and* 2 *of the note*, *inſtead of*—may be compared to, *read*—ſomewhat reſemble.
10, *line* 10, *after* colour, *add*—and moves forwards in the veſſels.
11, *line* 6, *inſtead of*—or, *read*—for.
26, *line* 14, *after*—or, *add*—equal.
40, *line* 7, *for*—are, *read*—is.
70, *line* 16, *for*—when, *read*—where.

By an overſight, there are two paragraphs numbered 77, and two others numbered 81, of which proper notice is taken, by adding the particular page where it was neceſſary to refer to thoſe paragraphs.—A few errors occur in the punctuation, but as they no where materially affect the ſenſe, they are left to the correction of the reader.

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